AMF 82-70 Maintance

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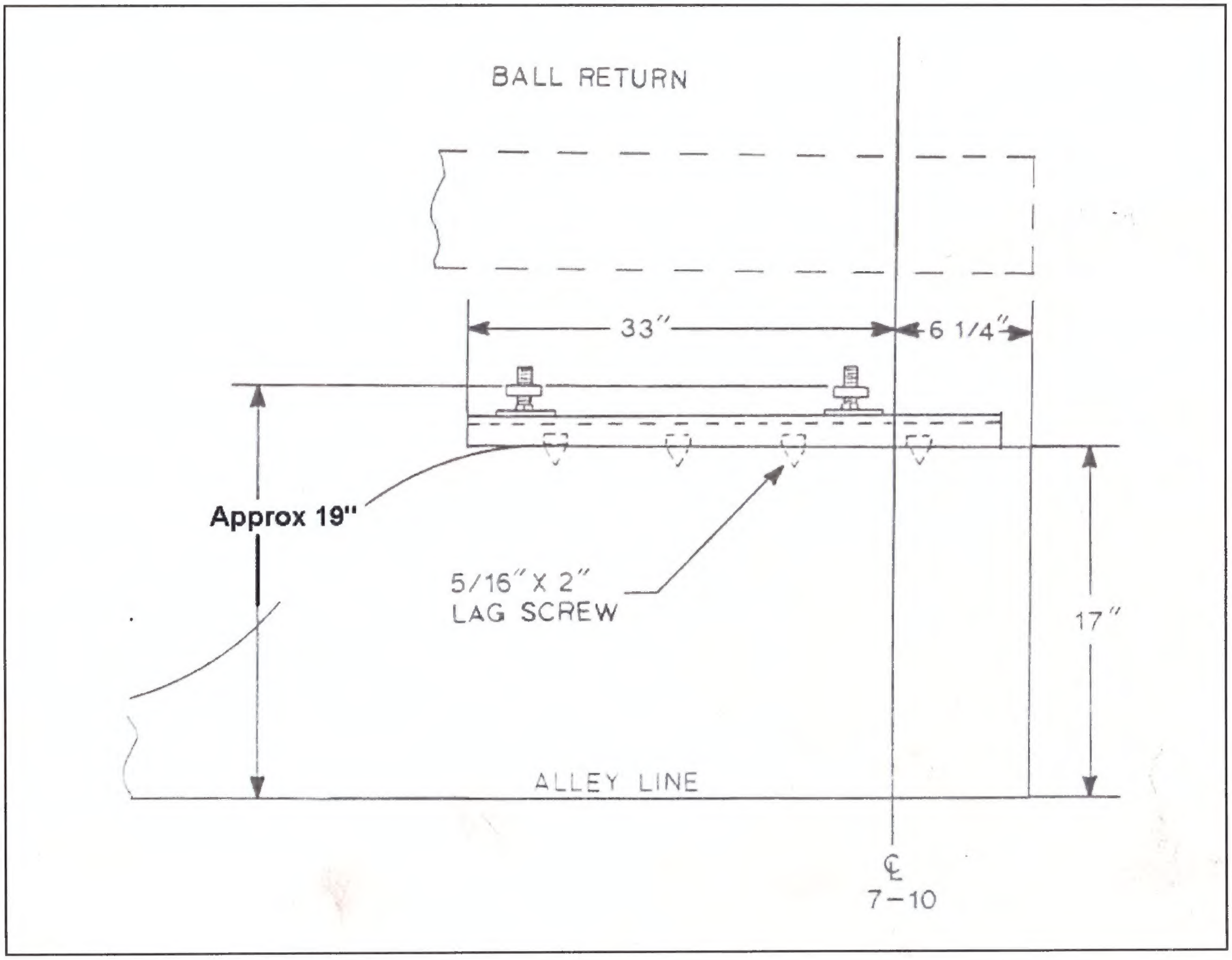

BALL RETURN
33″
6 1/4″
Approx 19"
5/16″ X 2″
LAG SCREW
17″
ALLEY LINE
℄
7–10

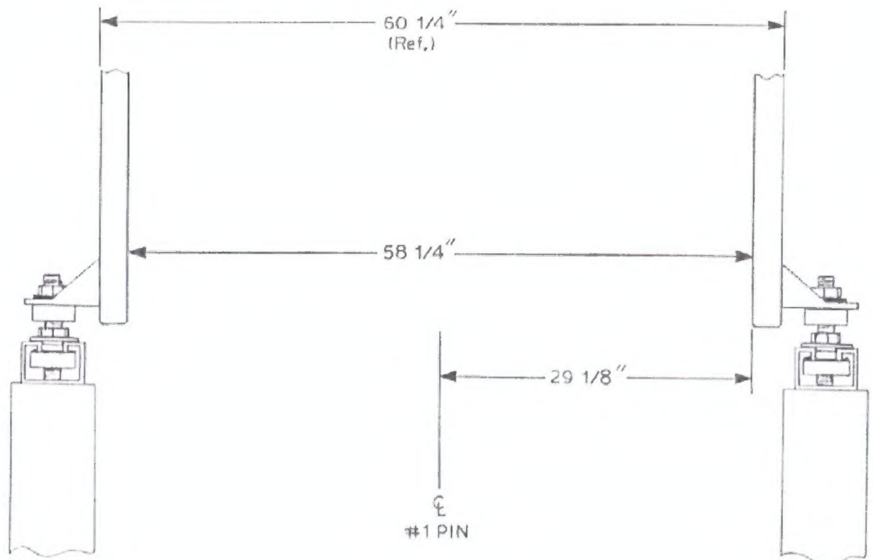
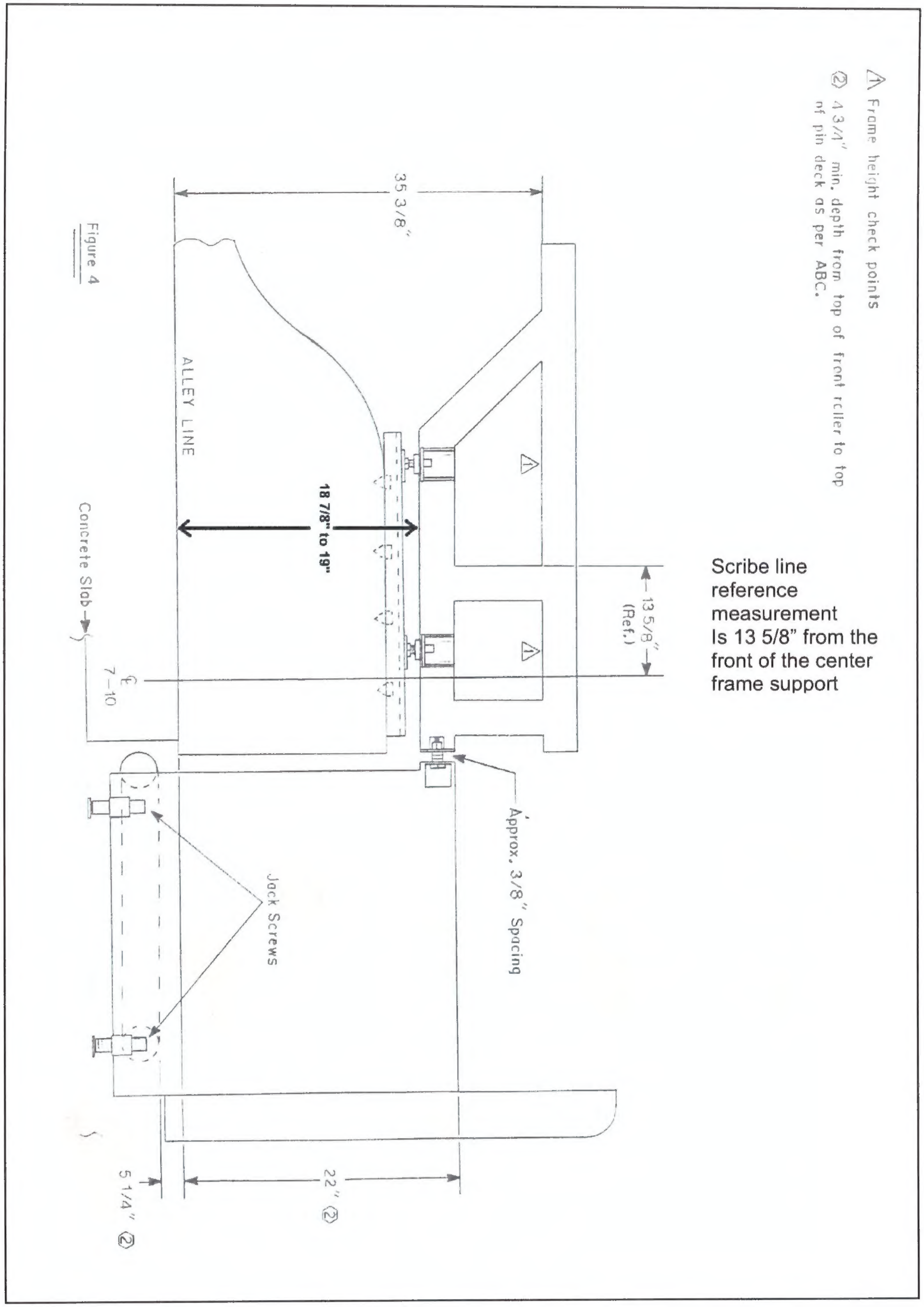


Figure 3

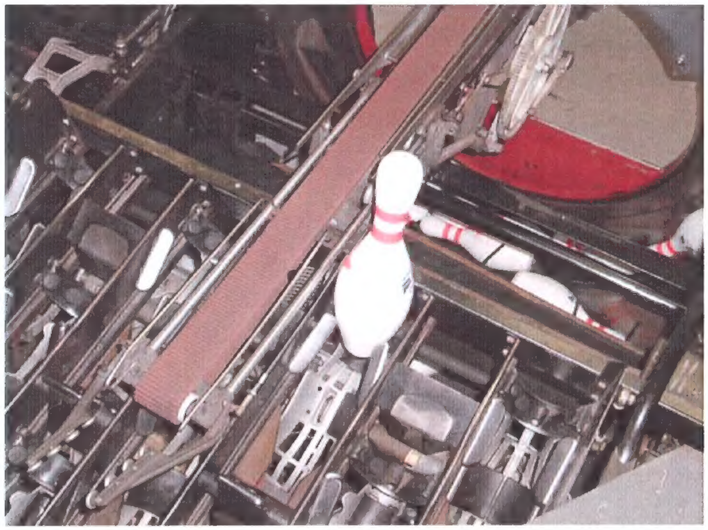


1 Frame height check points
2 4 3/4" min. depth from top of front roller to top of pin deck as per ABC.
35 3/8"
ALLEY LINE
18 7/8" to 19"
Concrete Slab
13 5/8" (Ref.)
℄ 7-10
Scribe line reference measurement Is 13 5/8" from the front of the center frame support
Approx. 3/8" Spacing
Jack Screws
22" 2
5 1/4" 2

Figure 4

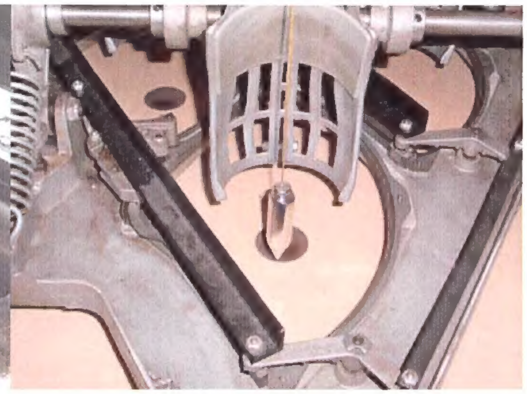
PROCEDURE FOR MEASURING MACHINE HIEGHT AND POSITIONING

- ❑ Turn on machine, run all the pins into the pit, turn off pit switch, place a pin in the back of the 9 pin slot of the bin to keep the bin switch closed.



- ❑ Cycle the machine to set a full rack, turn the machine off when the table is all the way down.
- ❑ Unplug the Russell Stoll plug and lock out the plug.
- ❑ Plug in your pin light jumper cord.

- [ ] Attach the plumb bob to the center of the #1 pin butt plate in the bin; the plumb bob should almost touch the lane surface. Note the position of the plumb bob.

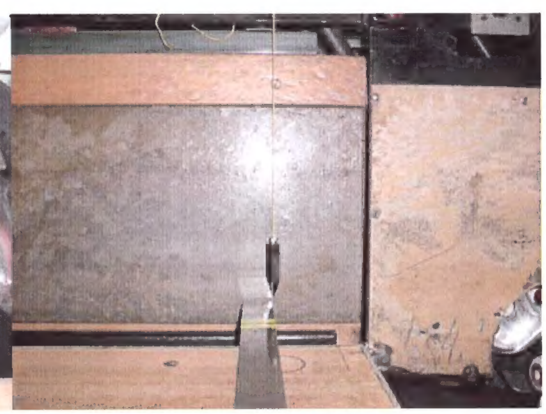


- [ ] Attach the plumb bob to the center of the #5 pin butt plate in the bin; the plumb bob should almost touch the lane surface. Note the position of the plumb bob.

- [ ] Crank the table back to the home position.

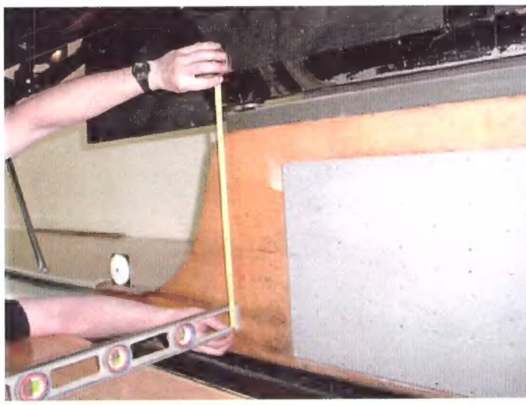
- [ ] Locate the 7 pin side scribe line; clamp the plumb bob on the frame so it hangs directly over the scribe line. Place a straight edge along the center of the 7-10 pin line; Note the position of the plumb bob in relation to the 7-10 center line.

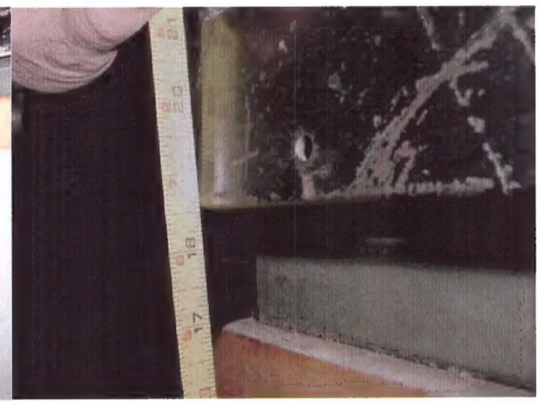
Note: You may have to mark the center of the pinspots along the 7-10 line.

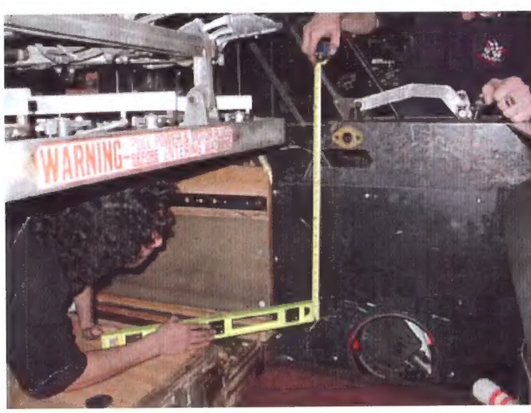
- [ ] Locate the 10 pin side scribe line; clamp the plumb bob on the frame so it hangs directly over the scribe line. Place a straight edge along the center of the 7-10 pin line; Note the position of the plumb bob in relation to the 7-10 center line.

- [ ] Measure and note the height of the machine over the pindeck at the four mounting feet positions, 7 pin front, 7 pin rear, 10 pin front and 10 pin rear.





- [ ] Measure and note the distance from the top of the pindeck to the top of the backend diamond plate, check this on the 7 and 10 pin sides of the machine. Check and note the level of both sides of the backend by placing the level on top of the kickback fiber plate.



- [ ] Remove pin from the #9 bin, unlock machine, turn on all switches, and set a full rack of pins.

THE RULES OF THE SCHOOL

1. Cell phones and pagers, turn them off or set them on silent
2. Always unplug and lockout the main power plug prior to working on the Pinspotter.
3. Obey all safety rules, these machines are dangerous, they can hurt and possibly KILL you.
4. Always callout "CLEAR" prior to powering or cycling any equipment.
5. The "book" is a starting point.
6. There is no bolt or nut on this machine designed to be "loose".
7. Keep your tools and parts in your bin; do not lay them around the machine.
8. One adjustment can and will effect another adjustment, always take wear into consideration when making adjustments.
9. Stay on task, we are running on a strict timeline. These machines need to run tonight.
10. Always offer your opinion or suggest another method if one is proven.
11. Use all resources available to you.
12. Leave it better than you found it, cleaner, tighter, and properly adjusted.
13. Clean up after yourself.
14. Leave all switches in the ready position for business use when you leave.
15. If you are unsure of how to proceed, ASK SOMEONE.
16. Take notes, study, listen, and READ the test questions.
17. NO SMOKING IN THE MACHINE AREA.
18. The instructor is capable of making mistakes.
19. Nobody likes a "KNOW IT ALL" All of us can learn something new every day.
20. ABSOLUTLEY NO DRINKS ON THE MACHINES.

82/70 PINSPOTTERS

MODEL	YEAR	CHASSIS TYPE	SERIAL NO.	LIFT	DESCRIPTION
70A	1962	5100 Electro Mechanical	90,001 12.2 RPM	Kicker Roller	2 Stepper relays in chassis. Complexed pin distribution (electric) and roll over bin.
70B	1964	6460 Electro Mechanical	95,151 12.2 RPM	Kicker Roller	1 stepper relay in chassis. Also called Z Machine redesign of shuttle, bin "Z" distribution (mechanical)
70C	1965	6700 S.S. Elco	99,191 12.2 RPM	Kicker Roller	Elco is name of PC card edge connector (green color) first solid state chassis (5 circuit boards)
70C	1965	6700 S.S. Elco	99,236 14.5 RPM	Kicker Roller	First hi speed combo motors.
70C	1966	6700 S.S. Elco	101,696 14.5 RPM	Kicker Roller	First single spot solenoid (was double solenoid).
70C	1968	6700 S.S. Elco	103,678	Kicker Roller	Changed combo motors back to 12.2 RPM
70C23	1974	7750 S.S. C23	141.XXX	Kicker Roller	First C23 chassis (same as 6700 except has round black 37 pin) AMP Connector for mask.
70C23	1976	7750 S.S. C23	142,225	PBL	First PBL. Note a PBL can be installed on any model AMF machine.
70 MP	1978	9800 MP	143,680	PBL	First micro-processor chassis (one circuit board) - also has C23 connector.

AMF Bowling Tech

Books / Special Tools

Part #	Description
#030-004-031	AMP Pin extractor
#792-512-019	AMP Crimping tool #1
#070-006-519	Respot cell gauge
#030-002-748	Sweep cam gauge
#070-006-587	Aluminum table locating tool (flag)
#090-005-525	Steel table locating tool (flag)
#030-003-943	Motor crank 70s
#090-002-021	Motor crank 90s
#610-000-009	Electrical manual
#610-007-028	82-70 Service and parts manual
#610-007-027	Basic Pinspotter instruction
#610-900-010	82-90 XL manual
#610-900-260	90XL manual
#000-027-655	5 prong receptacle
#000-027-660	5 prong plug
#000-025-078	Connector body
#000-019-201	Female terminal
#000-011-197	Male terminal

General Lubrication tips

Preventive Maintenance is a key to keeping your machines running at maximum efficiency. Following are some maintenance tips to help you improve machine operation and reduce costs for your center.

LUBRICATION

Read your lubrication charts. Many mechanics use the wrong lubricant believing it will perform better.

1. **LUBRICATING OIL** should be lightweight oil, no more than 30 weight. Gear oil is too thick for general lubrication and tends to gum up parts. Lightweight oil penetrates and lubricates much faster.

2. **GEAR OIL** is used in the gearbox only. Gearbox oil should be changed on a yearly basis. **AMF** 82-70 and 90 machines use 90-140W.

3. **BRAKE FLUID** is used to lubricate rubber parts. Brake fluid does not deteriorate rubber like oil or grease. Remember that all the parts contacting the rubber part need brake fluid, also. If any oil or grease touches a rubber part, it will cause that part to wear out prematurely.

4. **GREASE** is used in sealed bearings and other enclosed areas that cannot be easily reached, such as the spring tube assembly. Gear box clutch components and worm shaft splines should be greased.

5. **ANTI-SEIZE** is a special lubricant used to protect metal to metal contact points, or places where two or more different metals come into contact such as a steel bolt that threads into an aluminum casting. It will help eliminate moisture, dirt and vibration which can cause unnecessary thread wear and damage. Anti-seize allows for easier removal of a bolt. Anti-seize can be purchased at most auto parts stores.

Note:

Always clean the area you are lubricating. Dirt mixed with oil creates something similar to liquid sandpaper. Dirt is your enemy; keep your machines clean as well as lubricated.

Oilite type sleeve and flanged bearings are made of bronze or iron powder that is formed in a mold under extreme pressure. This material is porous and holds the oil in its pores, as heat builds up in the bearing the oil seeps from the pores, this keeps the bearing constantly lubricated. Some of these bearings are internally grooved and impregnated with a graphite compound for additional lubrication. If grease is used on these style bearings the grease will clog the pores. Once this happens, the bearing will begin to wear out as will the part it is meant to lubricate.

AMF PINSPOTTER SCHOOL TOOL KIT

check	part #	Description	check	part #	Description
	787-001-006	Drive punch set **(5)**		793-507-029	9/16" x 5/8" offset box wrench
	789-001-001	stubby Philips # 2		793-507-030	11/16" x 3/4" offset box wrench
	789-001-002	Philips # 2 x 4"		792-026-028	6' steel tape measure
	789-006-008	flat screwdriver 4"		789-505-008	ratchet 3/8" drive
	789-006-009	flat screwdriver 8"		789-502-003	3" extension 3/8" drive
	783-501-001	Hammer 16 oz. Ball peen		789-502-004	5" extension 3/8" drive
	783-502-002	Hammer plastic 16 oz.		782-501-001	11" extension 3/8" drive
	793-002-007	snap ring pliers		789-509-018	deep socket 7/16"
	786-503-003	slip joint pliers		789-509-030	deep socket 1/2"
	786-502-002	needle nose pliers		789-509-019	deep socket 9/16"
	786-504-004	diagonal cutting pliers		789-509-020	deep socket 5/8"
	786-501-001	channel lock pliers		789-509-021	deep socket 11/16"
	793-514-048	10" vise grip pliers		789-509-022	deep socket 3/4"
	793-501-041	3/8" x 7/16" box ratchet		789-509-023	deep socket 13/16"
	793-510-042	1/2" x 9/16" box ratchet (2)		780-503-014	3/8" drive Allen bit set
	793-510-043	5/8" x 11/16" box ratchet		793-501-002	8" adjustable wrench
	793-510-044	3/4" x 7/8" box ratchet		793-501-003	12" adjustable wrench
	070-006-974	1/2" X 9/16" open end wrench thin		070-006-519	gauge, respot cell **(3)**
	793-506-021	5/16" combination wrench		793-511-045	spanner wrench
	793-506-022	3/8" combination wrench		792-505-005	spring puller
	793-506-023	7/16" combination wrench		792-501-001	carpet removal pins **(2)**
	793-506-024	1/2" combination wrench		793-503-051	fold up Allen wrench set
	793-506-025	9/16" combination wrench		793-509-037	9/16" x 5/8" open end (Thin)
	793-506-026	5/8" combination wrench		030-002-748	sweep cam gauge
	793-506-027	11/16" combination wrench		Stahls tool	Carpet spring removal tool **(2)**
	793-506-050	3/4" combination wrench		AMF	Pin light jumper cord
	793-505-019	13/16" combination wrench		AMF	Motor crank
	793-505-020	15/16" combination wrench		070-006-587	Table flag **(3)**
	793-507-028	7/16" x 1/2" offset box wrench			

82-70 MP
Pinspotter Rapid Checks

WARNING - REMOVE POWER PLUG WHEN WORKING ON PINSPOTTER

MACHINE SWITCH OR CIRCUIT and the	PROBLEM IT MAY CAUSE
SA SWITCH BUTTON IN - same as SA CIRCUIT OFF [OPEN] -	Sweep will not stop at 270° - will interlock
SA SWITCH BUTTON OUT - same as SA CIRCUIT ON [GROUNDED] -	Continuous sweep run
SB SWITCH BUTTON IN - same as SB CIRCUIT OFF [OPEN] -	Sweep fails to stop at 66° - then runs continuously
SB SWITCH BUTTON OUT - same as SB CIRCUIT ON [GROUNDED] -	Machine won't cycle
SC SWITCH BUTTON IN - same as SC CIRCUIT ON [GROUNDED] -	No interlock protection
SC SWITCH BUTTON OUT - same as SC CIRCUIT OFF [OPEN] -	Interlock
TA1 SWITCH BUTTON IN - same as TA1 CIRCUIT OFF [OPEN] -	Table stops at 260°
TA1 SWITCH BUTTON OUT - same as TA1 CIRCUIT ON [GROUNDED] -	Continuous table run
TA2 SWITCH BUTTON IN - same as TA2 CIRCUIT OFF [OPEN] -	1st ball - sweep stops at 66° 2nd ball - sweep stops at 270° table runs continuously
TA2 SWITCH BUTTON OUT - same as TA2 CIRCUIT ON [GROUNDED] -	Sweep to 270° - no table run

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AMF BOWLING, INC.

82-70 MP
Pinspotter Rapid Checks

MACHINE SWITCH OR CIRCUIT	and the	PROBLEM IT MAY CAUSE
TB SWITCH BUTTON IN - same as TB CIRCUIT ON [GROUNDED] -		No interlock protection
TB SWITCH BUTTON OUT - same as TB CIRCUIT OFF [OPEN] -		Interlock
OS SWITCH BUTTON OUT - same as OS CIRCUIT ON [GROUNDED] -		Sweep to 66° - table picks up pins & stops after one revolution - 2nd ball normal
OS SWITCH BUTTON IN - same as OS CIRCUIT OFF [OPEN] -		Sweep clears deck when out of range occurs
SS SWITCH BUTTON OUT - same as SS CIRCUIT ON [GROUNDED] -		Continuous machine cycle
SS SWITCH BUTTON IN - same as SS CIRCUIT OFF [OPEN] -		Cushion will not cycle machine but cycle button will
GP SWITCH BUTTON IN - same as GP CIRCUIT OFF [OPEN] -	using C. & N.C.	Table will not feel for pins 2nd ball normal
GP SWITCH BUTTON OUT - same as GP CIRCUIT ON [GROUNDED] -	using C. & N.C.	Table will feel for pins with respot cells closed
BS SWITCH BUTTON OUT - same as BS CIRCUIT ON [GROUNDED] -		Table will spot pins without #nine in bin
BS SWITCH BUTTON IN - same as BS CIRCUIT OFF [OPEN] -		Table will not spot pins

610 007 046

AMF AMF INCORPORATED AMF
Bowling Products Group

82-70 Solid State Chassis

Pinspotter Rapid Checks

WARNING - REMOVE POWER - THEN WAIT ONE MINUTE BEFORE REMOVING CIRCUIT BOARD

NOTE: P. C. Board replacement is in the order that would most likely have caused the machine malfunction. See reverse side for additional hints on handling circuit boards. Use board puller 82-70-6599 to remove circuit boards.

TROUBLE	REMEDY
SWEEP	
1. SWEEP DOES NOT DROP TO GUARD POSITION	Replace P. C. Board #1 or #3
2. NO SWEEP RUN - - - - - - - - - - -	Replace P. C. Board #1 or #3
3. SWEEP TIME DELAY TOO LONG OR TOO SHORT	Replace P. C. Board #1 or #3
4. NO TIME DELAY - - - - - - - - - -	Replace P. C. Board #1 or #3
5. SWEEP RUNS CONTINUOUSLY - - - - -	Replace P. C. Board #1
6. SWEEP RUNS INTO TABLE - - - - - -	Replace P. C. Board #1
7. SWEEP & TABLE OUT OF TIME - - - - -	Replace Auxiliary P. C. Board
TABLE	
1. TABLE RUNS CONTINUOUSLY - - - - -	Replace P. C. Board #1 and #2
2. TABLE WILL NOT SPOT PINS (Spot Relay) - -	Replace P. C. Board #1, #3, #2
3. TABLE AND SWEEP CHATTER - - - - -	Replace P. C. Board #1, #3, #2
4. NO TABLE RUN - - - - - - - - - - -	Replace P. C. Board #1, #2, #3, #5
5. TABLE OUT OF TIME - - - - - - - - -	Replace P. C. Board #5
6. TABLE (No Time Delay) - - - - - - -	Replace P. C. Board #1, #3, #5
7. NO STRIKE CYCLE - - - - - - - - - -	Replace P. C. Board #1, #2, #3
8. FALSE STRIKE - - - - - - - - - - -	Replace P. C. Board #2, #1, #3
9. NO FOUL - - - - - - - - - - -	Replace P. C. Board #2
PINDICATOR	
1. NO PINDICATION - - - - - - - - - -	Replace P. C. Board #4, #3, Pinlight Triac
2. PIN LITE ON CONTINUOUSLY - - - - -	Replace P. C. Board #4
3. 1st AND 2nd BALL LITE ON CONTINUOUSLY -	Replace P. C. Board #4, #3
4. FOUL LITE ON CONTINUOUSLY - - - -	Replace P. C. Board #1, #3
5. CONTINUOUS FOUL - - - - - - - - -	Replace P. C. Board #1
SPAREMAKER	
1. WILL NOT COMPUTE - - - - - - - - -	Replace P. C. Board #6, #1, #2, #3
2. WRONG ARROWS - - - - - - - - - -	Replace P. C. Board #6, #1, Replace Chassis
3. NO ARROW - - - - - - - - - - -	Replace Bulb
4. CONTINUOUS SEARCH - - - - - - - -	Replace P. C. Board #6

AMF AMF

82-70 Solid State Chassis

Pinspotter Rapid Checks

TROUBLE	REMEDY
GENERAL	
1. MACHINE INOPERATIVE - - - - - - -	Replace P.C. Board #5
2. FUSE F-1 (½ Amp) AND FUSE F-2 (2 Amp) ON P. C. #5 BLOWN - - - - - - - - -	Replace P.C. Board #5
3. NO CYCLE START - - - - - - - - - -	Replace P.C. Board #1, #3, #5, #2
4. FALSE STRIKE CYCLE - - - - - - - - -	Replace P. C. Board #3, #2, #1
5. MACHINE CYCLES WHEN TURNED ON - -	Replace Aux. P. C. Board
6. NO INSTRUCTOMAT - - - - - - - - -	Replace P. C. Board #1, #2
7. STRIKE LITE ON, MACHINE NORMAL - -	Replace P. C. Board #4
8. WILL NOT SPOT PINS or SPOTS PINS 1st BALL	Replace SP Relay
9. NO SWEEP DOWN or SWEEP RUN w/SWITCH	Fuse F-3 or M Relay Defective
10. MACHINE STAYS IN 1st OR 2nd BALL - -	Replace Aux. P. C. Board

> After Locating A Defective Board, Examine It Closely For Broken Or Loose Components. Using A Pencil Eraser, Clean The Electrical Contacts Where They Mate With The Terminal Strip.
>
> RECHECK SUSPECTED BOARD IN ANOTHER MACHINE CHASSIS BEFORE RETURNING TO AMF FOR REPAIR.

WHEN HANDLING PRINTED CIRCUIT BOARDS
THE FOLLOWING RULES SHOULD BE KEPT IN MIND

1. Do Not Flex The Circuit Board. This Could Damage The Wiring.
2. Do Not Remove The Circuit Board When Power Is On.
3. Refrain From Writing On Circuit Boards. This Could Cause A Short Since Carbon Is A Conductor.
4. If It Is Necessary To Indicate A Defective Part Or Solder Joint, Do So With A Small Piece Of Masking Tape.
5. Store The Spare Circuit Board In A Protective Container.

"9800" SERIES MP CHASSIS PIN-OUT LEGEND

C-1 High Voltage power circuits

13 L	Machine Neutral	22 J	Sweep Motor—Main Windings
16 Z	Machine Neutral	23 N	Sweep Motor—Braking
17 dd	Sweep Reverse Switch	24 T	Sweep Motor—Braking
18 JJ	Sweep Reverse Switch	31 A	Table Motor—Main Windings
19 NN	Pinsetter Ground	32 E	Table Motor—Braking
21 D	Machine Neutral	33 K	Table Motor—Braking
34 P	Machine Neutral	**45 W**	**Backend Motor Power**
27 FF	Sweep Motor—Start Windings (SMP-Y)	**46 AA**	**Backend Motor Power**
26 bb	Sweep Motor—Start Windings (SMP-Z)	41 C	Input Power
35 u	Respot Solenoid, only used if mach has 2 solenoids	42 H	Input Power
36 Y	Spotting Solenoid	47 EE	Input Power
44 S	Deck Light		

C2-A Low voltage control circuits

11 B	Sweep/Table Switch	212 EE	Stepper Circuit (PBZ)
12 F	Ground	31 A	10th Frame (Power Lift/Ball Detect)
13 L	Pit Motor Toggle	32 E	10th Frame (Power Lift/Ball Detect)
14 R	Cushion Start Switch (N/C) & PBC	33 K	Power Lift Control
15 V	Front Desk Control 24 VAC	34 P	Power Lift Control
16 Z	Sweep Motor Toggle	35 U	TB (N/O) & SC (N/O) Interlock Circuit
17 d	Foul Light Input 12VAC	310 t	Ground
18 j	Master CB	311 x	SB (N/C)
19 p	Table Motor Toggle	312 BB	Ground
110 u	TA1 (N/C)	313 FF	Pit Motor Toggle
112 cc	BS (N/C)	41 C	GS #1
113 HH	24VAC—(Spare)	42 H	GS #2
21 D	Sweep Run SWS (N/O)	43 M	GS #3
23 N	Front Desk Control 24VAC	44 S	GS #4
24 T	Out-Of-Range (N/C)	45 W	GS #5
25 X	Not in most MP chassis, if it is used it goes to BS NC & TA2 NO	46 a	GS #6
26 b	Master CB	47 e	GS #7
27 f	SA (N/O) SWS (N/O) PBC	48 k	GS #8
28 m	GP (N/C)	49 r	GS #9
29 s	SA (N/C)	410 v	GS #10
210 w	Ground	411 z	Not used on MP chassis
211 aa	TA2 (N/C)	412 DD	Ground

Mask "MP Plug"

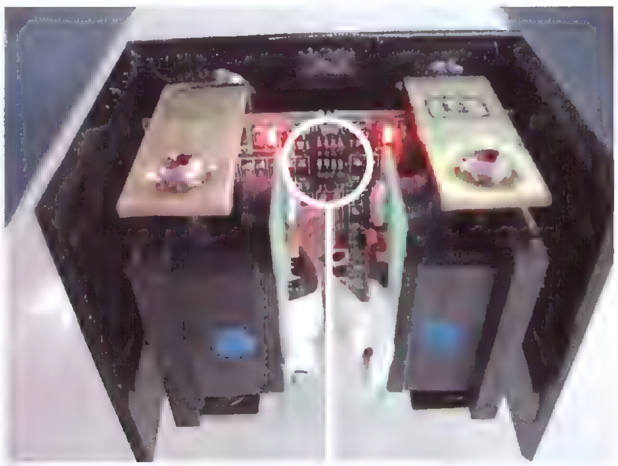
1	12 VDC Lights (rectifier reduces voltage from 16 to 12)	23	Light #10
2	Masking Unit Switch	24	1st Ball Light
14	Light #9	25	2nd Ball Light
15	Light #7	26	Strike Light
16	Light #5	27	Foul Indicator
17	Light #3	28	Masking Unit Switch
18	Light #1	29	12 VDC
19	Light #2	33	Ground
20	Light #4	35	Plug Key (No Connection)
21	Light #6	37	Plug Key (No Connection)
22	Light #8		

APS-Scoring "APS Plug"

1	CWC Foul (+)	22	RPO Ground
2	CWC Foul (-)	29	Scoring Data
3	2nd Ball Pulse (+)	30	Scoring Data Ground
4	2nd Ball Pulse (-)	32	Scoring Clock
5	Take Data Switch (+)	33	Scoring Clock
6	Take Data Switch (-)	34	Plug Key (No Connection)
21	RPO (+)	35	Plug Key (No Connection)

AMF Ball Detect Timing Settings

Setting #	Switch 1	Switch 2	Switch 3	Comments
7	off	off	off	Maximum delay
6	on	off	off	
5	off	on	off	
4	on	on	off	
3	off	off	on	
2	on	off	on	
1	off	on	On	Minimum delay
0	on	on	On	No delay
Switch #4, if present, does not affect any timing				



ELIMINATION OF TABLE WIRING

By: Rick Lussier

The Pinspotter table wiring harness and the 10 gripper switches on the respot cells were originally used to tell the chassis there was a pin present in a respot cell. This information was also passed on to the sparemaker chassis, the sparemaker displayed arrows on the masking units telling the bowler where to throw the ball.

Upon the development of the MP chassis, engineers incorporated a circuit that enabled the AMF automatic scoring to send the strike signal to the machine.

With the addition of pin indication graphics used on AMF Automatic scoring systems, it became evident that there was no need to continue using table wiring and associated sparemaker wiring.
In fact the 82-70 XL and the 82-90 XL do not have a table harness.

If you have both AMF machines and scoring, most likely there is a product available to upgrade your center and eliminate the need to maintain table wiring.

Some centers may be using these products but are not taking full advantage of them.

82-70 MP CHASSIS

Machines with MP chassis will already be tied into scoring but should be tested to see if table wiring circuit is still connected.

TEST

1) Turn machine on, sweep pins off deck and be sure machine is on first ball. Cycle machine with respot switch located on rear control panel. If machine goes through strike cycle follow steps below to eliminate table wiring.

82-70 SOLID STATE 5 BOARD CHASSIS

Solid State chassis can be upgraded with AMF part 610 709 870 XOP board and 070 009 872 cable assembly.

If you are currently using the OmegaTek MK 70 board you can purchase the Expander. Detailed installation instructions are provided with these products.

After you have installed one of these products, you can eliminate the table wiring.

NOTE: Centers using Masking Unit pindication can not eliminate this circuit.

1) Remove the left hand cross beam cover located at the front of the machine. This will expose the TAC terminal board. Terminals 1-10 are for the gripper switches, terminals marked SW are for the gripper protection switch; the remaining terminal is a ground.

2) Identify the table cable wires (these are usually smaller in size)

3) Disconnect table cable wire from ground terminal.

4) Disconnect wire from terminal number 7 that runs to C2A plug and install on ground terminal. This disables the table strike circuit.

5) The table cable ground wire may be installed on terminal 7 at this time.

6) The gripper protection circuit can be disabled at this time. Locate table cable wires connected to the terminals marked SW and remove.

7) The wires remaining are then installed on the same terminal.

8) The table cable wires removed can be installed on the terminal left open or the complete upper table cable can be removed at this time.

TEST

1) Turn machine on, sweep pins off deck and be sure machine is on first ball. Cycle machine with respot switch located on rear control panel. Machine should not go through a strike cycle.

2) Switch machine back to first ball and cycle by pulling the cushion. Machine should go through a fast strike cycle (no table run). If this does not occur it may be necessary to turn the scorer on, enter bowler names, press start bowling and retest. There are a few scorer software levels that require this.

ONE FINAL NOTE:

Eliminating the table wiring harness does not eliminate the need to maintain the respot cell yokes and gripper switches; these must be properly maintained to ensure that pins are picked up and held by the respot cell fingers.

CB ON THE REAR CONTROL PANEL

Certain components of the Pinspotter are used in different circuits depending on the chassis being used.

The circuit breaker on the rear control panel is one of these components. If it's winding should open, (burn out) the problem that results will be completely different depending on which chassis is being used.

Terminals A and B of the breaker are simply an on-off switch. C and D are the terminals of the current monitoring winding. When this winding opens there is a problem.

When using an MP chassis an open winding will prevent the machine from spotting pins. The cycle will be completed but there will be no pins on the deck. Also the automatic sweep reverse feature will not function.

When using a five board chassis, the neon lamp voltage supply will not operate. If the number one board is using neon lamps in the input circuit, the machine will not cycle. However, if the number one board is equipped with LED optocouplers the machine operates normally.

The newer circuit breakers have two additional terminals, E and F. They are used in the red stop button circuit. If the winding for E and F should open the stop button and the CIS would not stop the machine.

SWS

The sweep run switch is a DPDT momentary switch; this means that is spring urged to one side.

When actuated, the common terminals connect to the opposite side of the switch terminals.

This switch provides a ground path to operate the "S" (sweep) relay through its normally open contacts, when the switch is activated the N.O. contacts close and provide the ground to operate the relay.

The N.C. contacts of this switch are in a "series" circuit with the start switch SS.

When the switch is actuated, it deactivates the SS circuit at the same time it activates the sweep relay, this is to prevent the machine from accidentally cycling during a "sweep run" operation.

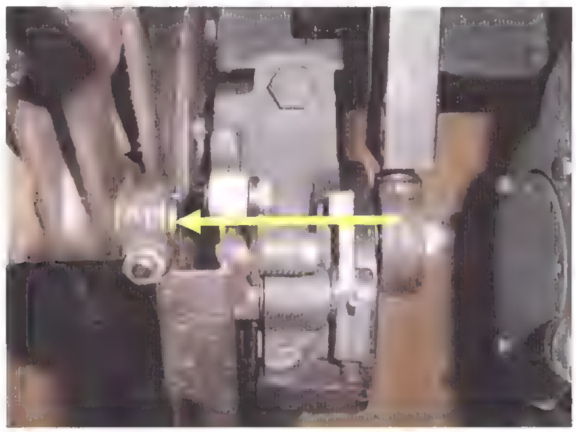
If the normally closed contacts of this switch are defective, the SS circuit will fail.

In order to test the N.C. contacts it is necessary to jump out the SS terminals or manually actuate the SS.

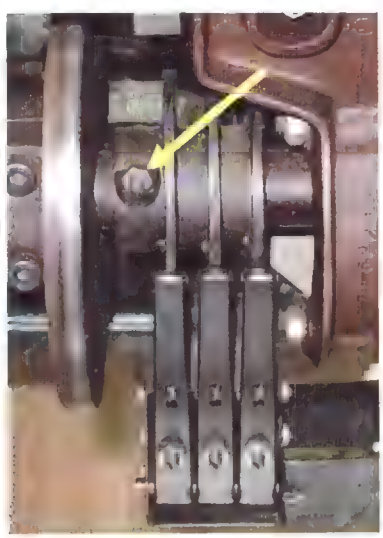
REPOSITIONING THE SWEEP AND TABLE CAMS

If the table or sweep cams become loose and spin on the shaft, use the following procedure to put the cams back in a "good starting point" then fine tune the cams to obtain the correct table and sweep stopping positions.

- ☑ Unplug the machine and lock out the machine.
- ☐ Crank the table to the proper home position of 355^0 this is when the front side of the white roller for the table drive latch is in the middle of the Spot solenoid shaft

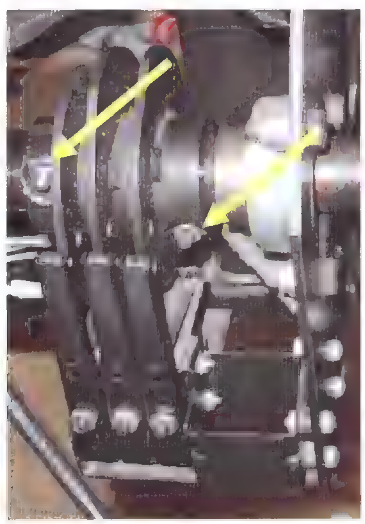


- ☐ Loosen the clamping stud on the table cams and rotate the cams until the clamping stud is parallel with the lane surface, then tighten the clamping stud.



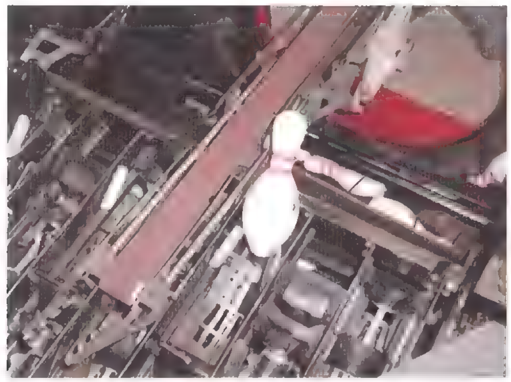
- [ ] Crank the sweep to the home position of zero^0, this is when the 3162 rod is in the middle of the sweep crank arm.

- [ ] Loosen the clamping studs on the sweep cams and rotate both cams until the clamping studs are parallel with the lane surface. Tighten the clamping studs.



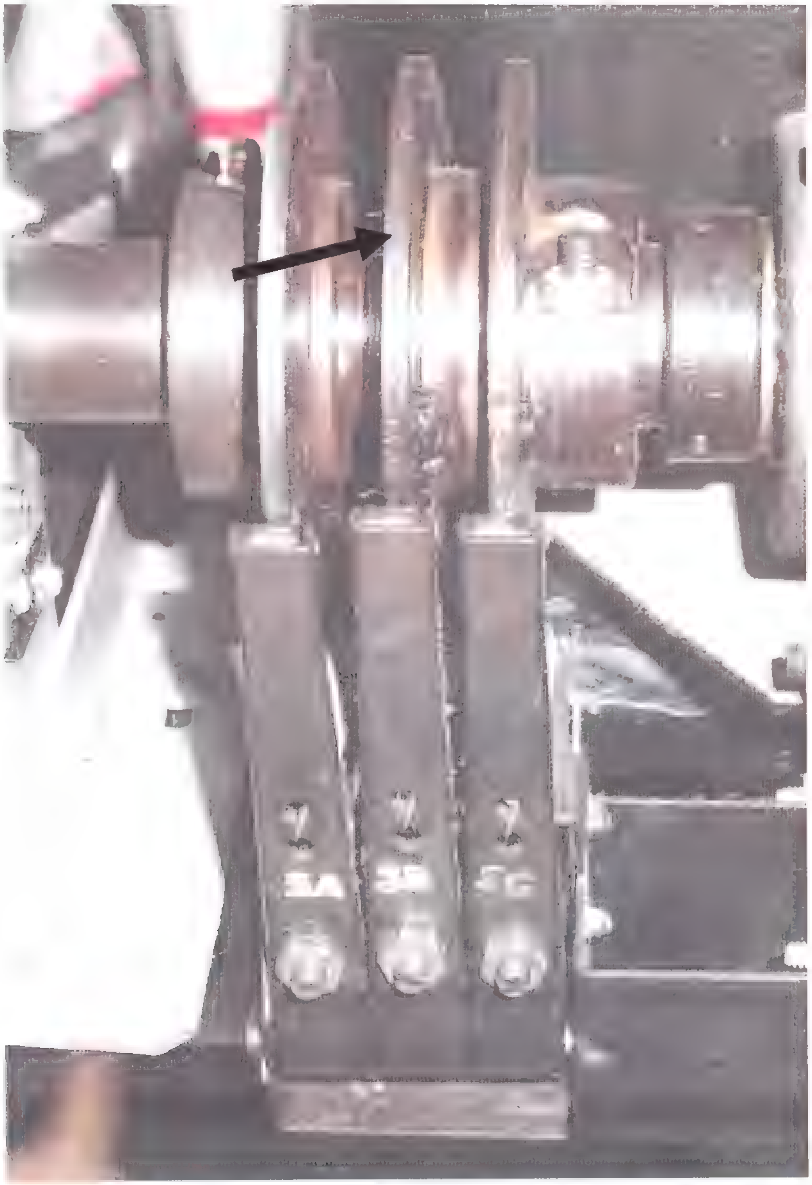
SWEEP AND TABLE STOPPING POSITIONS WORK CHECKLIST

- ☐ Turn on machine, run all the pins into the pit, turn off pit switch, place a pin in the back of the 9 pin slot of the bin to keep the bin switch closed.

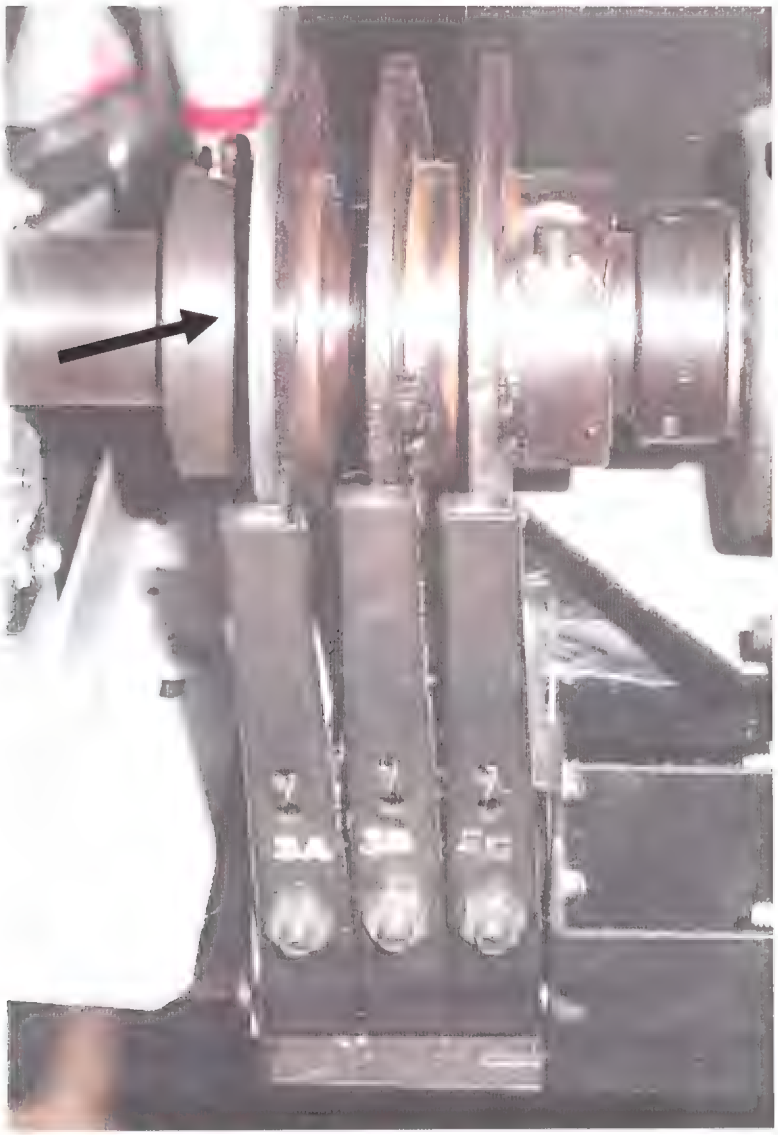


- ☐ Check the sweep cam lever springs, make sure they are not stretched.
- ☐ Lube the cam lever rollers with some light oil; make sure the rollers move freely.
- ☐ Adjust the sweep cam levers with the 2748 tool.
- ☐ Using the adjusting bolt on the bottom of the cam lever adjust the bolt so the small side of the gauge does not make the switch click, and the large side of the gauge makes the switch click.
- ☐ Crank the sweep in the normal direction of rotation until the flat side of the SA cam is facing the cam lever roller, adjust the SA cam lever.
- ☐ Crank the sweep in the normal direction of rotation until the flat side of the SB cam is facing the cam lever roller, adjust the SB cam lever.
- ☐ Crank the sweep in the normal direction of rotation until the flat side of the SC cam is facing the cam lever roller, adjust the SC cam lever, **and then turn the adjusting screw in an additional ½ turn clockwise.**

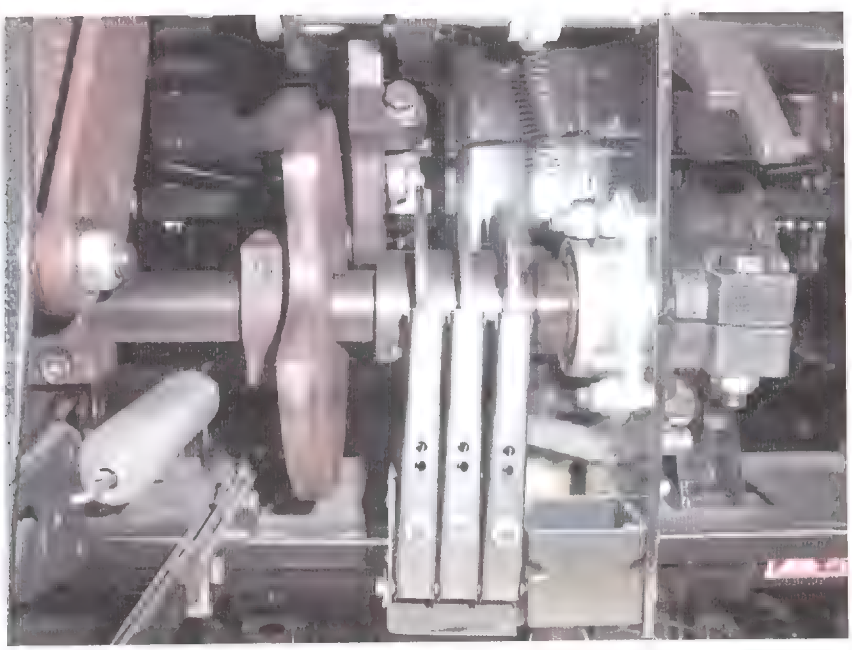
- [ ] Check the 1st guard stopping point by cycling the machine. Adjust the SB cam (middle cam) to obtain the correct 1st guard stopping point. If the sweep stops too soon (high) retard the cam, if it stops too late (goes down and back) advance the cam.



☑ Check the 2nd guard stopping point by cycling the machine. Adjust the SA cam (LH cam) to obtain the correct 2nd guard stopping point. If the sweep stops too soon (does not come forward enough) retard the cam. If the sweep stops too late (comes forward and up) advance the cam.



- [x] Check the Table cam lever springs; make sure they are not stretched.
- [x] Lube the cam lever rollers with some light oil; make sure the rollers move freely.
- [x] Adjust the Table cam levers with the 2748 tool.
- [x] Using the adjusting bolt on the bottom of the cam lever adjust the bolt so the small side of the gauge does not make the switch click, and the large side of the gauge makes the switch click.
- [ ] Crank the Table in the normal direction of rotation until the flat side of the TA1 cam is facing the cam lever roller, adjust the TA1 cam lever.
- [x] Crank the Table in the normal direction of rotation until the flat side of the TA2 cam is facing the cam lever roller, adjust the TA2 cam lever.
- [x] Crank the Table in the normal direction of rotation until the flat side of the TB cam is facing the cam lever roller, adjust the TB cam lever, **and then turn the adjusting screw in an additional ½ turn clockwise.**



- [x] Cycle the machine though a spotting cycle and check the 355^0 stopping point.
- [x] Adjust the table cams to obtain the correct stopping position, the TA1 cam (LH cam of cluster) controls this 355^0 stopping point.
- [x] If the gap between the notch in the table drive eccentric and latch is too big, or if the white roller is too far back, retard the cams.
- [x] If the gap is too small, or if the white roller is too far forward, advance the cams.

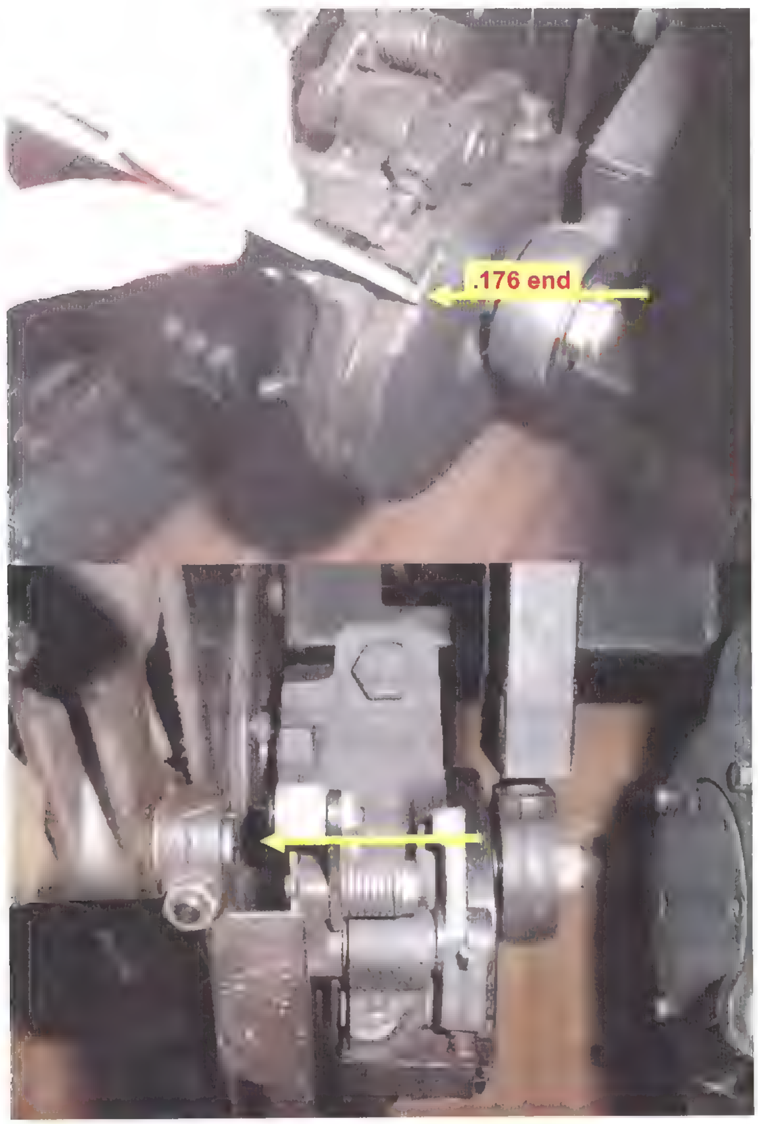
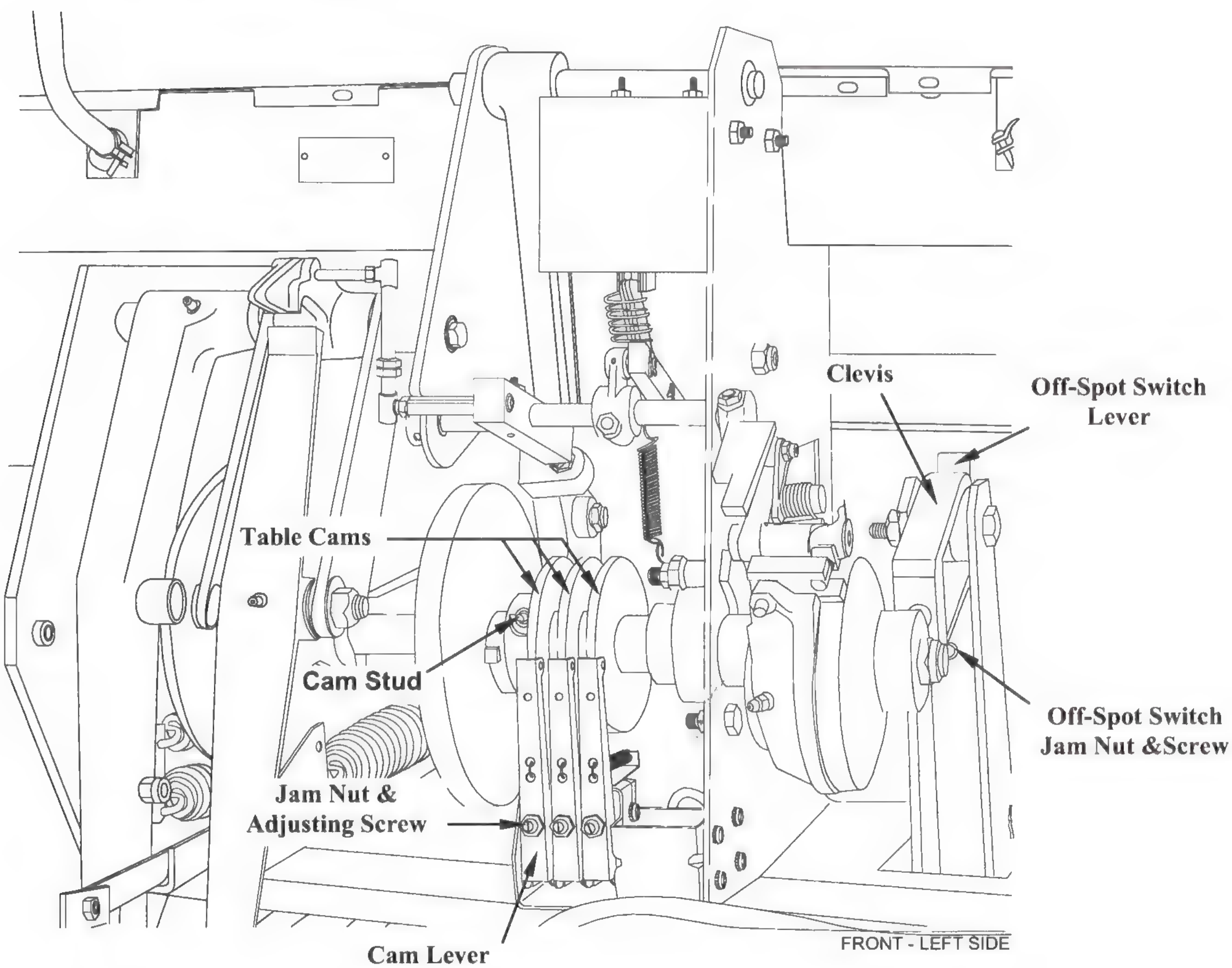


Table Off-Spot Switch Operation and Adjustment

When the table contacts an off-spot pin during a respot cycle, the table stops its downward movement, but clevis movement continues causing it to contact the off-spot lever actuating the off-spot switch. This action places the machine in a 2nd ball cycle, causes the table to return to the home position, and holds the sweep at the 1st guard position.

As necessary, adjust the off-spot switch as follows:

- ❑ With the table at the home position, loosen the off-spot adjusting screw jam nut located on the table arm just below the clevis (see Figure 4-15).



- ❑ Using gauge 030-002-748, insert the thicker end of gauge between the off-spot switch lever and the clevis. Adjust the screw counterclockwise to the point of switch operation.
- ❑ Remove the gauge. When the thinner end of the gauge is inserted, the switch should not actuate.
- ❑ Hold the screw in position and tighten the jam nut.

To check above adjustment:

a. Cycle the machine through the 1st ball cycle with a pin placed out of range.

b. The sweep should drop to the 66° (1^{st} guard) position.

c. The table should contact the pin and return to the zero (home) position.

d. The 2nd ball light should turn on.

Remove any fallen pins, open the respot cell fingers, and operate the sweep reverse switch to bring the sweep to the home position and continue play.

- ❑ Have the instructor check your adjustments.

82-70 sweep

Rule # 1, There are no nuts or bolts designed to run loose.

Rule # 2, Both sides (7&10) of the sweep assembly are assembled identically, the only differences are:

The 3116 rod connection at the drive link.
The telescoping tube connection at the short links.
Sweep shock mount.
Upper saddle spacers.
These items are installed in the opposite direction.

Rule # 3, The sweep links are made of aluminum, they are soft and will bend if hammered, the bushings in these links must be pressed in or out using a vise or arbor press. Once the links get bent they will more than likely break if you try to straighten them.

Rule # 4, The sweep links are connected with soft steel pins, these should be a "slip fit" they should not require any more than some mild tapping with a soft faced hammer to install.
When they are removed you must check the ends of the pins to be sure they have not been "mushroomed" by hammer blows.
If the ends are mushroomed, they must be filed clean prior to removing.

Rule # 5, Both sides of the sweep should be overhauled in pairs, it is difficult to obtain proper adjustment when on side is worn out and the other side is in "like new condition"
If you mark all connection points, and overhaul one side of the pantograph assembly at a time, the chances of putting it together wrong are greatly reduced.

SWEEP CONTROLS

The sweep is started by SS, PBC, or the tenth frame switch.

1st guard stopping point is at 66 degrees of sweep shaft rotation, and is controlled by cam and switch SB.

Sweep run through is initiated by cam and switch TA2 at 186 degrees of table shaft rotation, this occurs just after the table hits BDC on the first stroke of the table.

2nd guard stopping point is at 270 degrees of sweep shaft rotation, and is controlled by cam and switch SA.

The sweeps run to the home position is initiated by TA2 in an MP chassis, or TA1 in a 5 board Elco chassis. Once initiated, the stopping point is controlled by cam and switch SA.

Table spotting is initiated by SB at 186 degrees of sweep shaft rotation; this is just after the sweep reaches the end of the lane and starts to run forward.

SWEEP COMPONENTS

Sweep motor and gearbox:
This motor drives the sweep assembly via the gearbox and sweep shaft, normal rotation of the gearbox and shaft is counter clockwise as viewed from the right hand (10 pin side of the Pinspotter)

This motor is reversible; it can be reversed manually using the SWSR switch and the sweep run switch on the rear control panel of the Pinspotter.

Sweep shaft:
This shaft drives the sweep crank arm, mounted on this shaft are the sweep cams, the SA cam is separately adjustable from the SB and SC cams, these cams are held in position by clamp studs (**do not over tighten these, the threads can strip easily**). The gearbox end of the shaft is splined and engages the output shaft of the gearbox, the opposite end of the shaft is keyed using a "woodruff" style key, this key positions the crank arm.

Sweep crank arm:
This arm transmits the movement of the sweep motor / gearbox to the # 3162 link. The bolt on the arm clamps the arm into place on the sweep shaft and key. This bolt should have the head facing down (toward the lane) when the sweep is at zero degrees. This prevents the threads and nut from coming into contact with the sweep rocker shaft as the sweep begins to drop to 1st guard position.

Sweep rod # 3162, some mechanics call it the 101/8" rod:
This rod transmits the movement of the crank arm to the rocker shaft, it has a minimum length dimension 10 1/8". This minimum must be maintained, if the rod is adj. too short the rocker shaft end on the 7-pin side will hit the back of the table motor gearbox and eventually lead to failure of the rocker shaft. The length of this rod is used **primarily to adjust how far rearward the sweep will travel to the 7-10 line**; however it will change other adjustments in the sweep pattern, home height position, and guard stopping points.

Sweep rocker shaft:
The rocker shaft transmits the movement from the # 3162 sweep rod to the # 3116 sweep rods that are connected to the sweep pantograph drive links.

Sweep rods # 3116, turnbuckles:
These rods are used primarily to adjust the height of the sweep at the home position or zero degrees; a good starting point for home position is adjusting the rods until the bottom of the sweep bar is approximately 24" off the lane surface. A minimum clearance of 1/2" must be maintained from the top of the stabilizing link to the bottom of the box beam. These rods can have and effect on sweep height at 1st guard if they are too short, they can also change and the distance the sweep travels rearward, but they should not be used to adjust 1st guard height or sweep travel.

Drive link:
This transmits the movement of the sweep links to the sweep pantograph assembly, Motion is transmitted from the sweep rocker shaft to the drive link by the # 3116 rods, The # 3116 rods are connected to the drive links by a special threaded stud. The drive link has a long bolt installed on it to keep the pantograph assembly from collapsing should it move too far rearward.

Stabilizing link:
This is the uppermost link of the sweep pantograph assembly. It stabilizes the components of the pantograph between the drive link and stabilizing link.

Sweep links:
There are four of these links in the lower portion of the pantograph assembly, three are identical, and one has a boss on the side to attach the sweep shock mount. These links have one bent end and one straight end, they should never be connected together straight end to straight end, or bent end to bent end, they always connect straight end to bent end. When connected properly the centerline of the pivot should be in line with the center of each link.

Threaded link # 3223:
This link is threaded into the # 3222 bracket, its primary function is to adjust the height of the sweep at guard position. In some cases the adjustment of the # 3116 link can override this adjustment. This link must be at right angles to the frame of the machine, if it is not at a right angle (90 degrees) it can break off. This will also effect the adjustment of the sweep at the 4-5-6 line.

Sweep bracket # 3222:
This bracket is located on the side frames of the Pinspotter, they are used to adjust the sweep height when it is centered over the 4-5-6 pinspots, downward movement will raise the sweep, and upward movement will lower the sweep.

Telescoping link:
This is a two piece link, These are used in conjunction with the threaded links #3223, and bracket #3222 to adjust the sweep at 1st guard and at the 4-5-6 line. In some cases, if adequate adjustment is not possible, washers or additional bumpers may be installed or removed on the inner shaft of this link to obtain proper adjustment. The rod ends of these two components must be tight on the shafts of each side of the link, additionally, the tube uses a ball joint with short threads.

Sweep shock mount:
This rubber mount is used to isolate and absorb the shock the sweep bar encounters, if it fails the sweep can jam and cause severe damage to the sweep assembly, it should be checked and replaced if it shows any cracks.

Sweep mount (82-90):
This one-piece mount eliminates 10 parts associated with the original style sweep mounting, they should be installed in pairs.

Sweep bar:
The sweep bar is attached to the sweep pantograph by either the older style sliding mount or the newer style 82-90 mount. The bolts that connect it to these mounts should have a washer under the head of the bolt and secured with an acorn style nut, the acorn nut helps reduce pin damage.

Sweep bar urethane inserts:
These are designed to help remove pins from the flat gutters, if they are not installed the sweep can jump over the pins. The 82-90 machines do not have these installed due to the 82-90 style sweep mounting brackets.

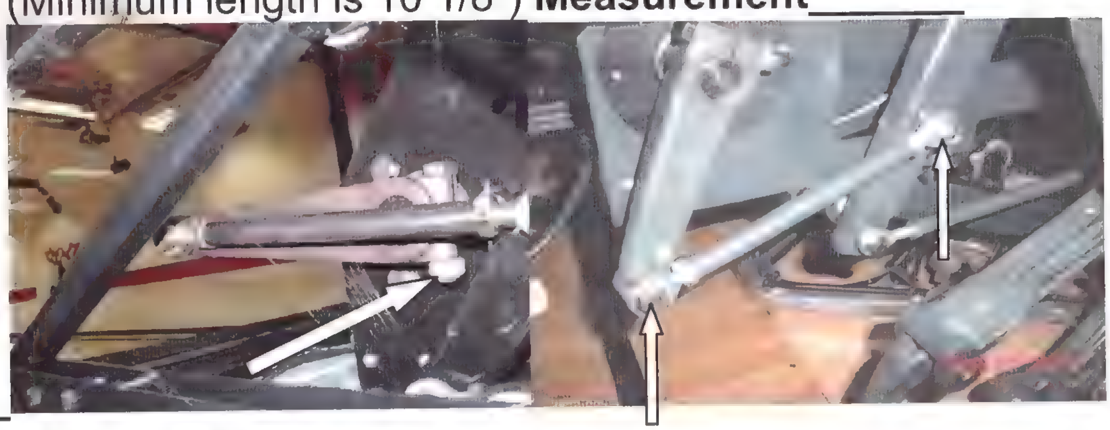
Sweep noise leaving 1st guard:
Sometimes the sweep will make a loud popping sound when it leaves first guard.

The sweep may even jump as it starts to move toward the tail plank. Very often this is even more noticeable the first time the machine is used each day and will be less objectionable as the day goes on.

This condition can be caused by the bumper (000 023 216) on the stabilizer link becoming soft and sticky.
Replacing the bumper will correct the problem and eliminate the noise. It is best to replace the bumper on both stabilizer links.
When the bumpers are replaced the height of the sweep at its home position may change and require adjustment.

SWEEP ADJUSTMENT / WORK CHECKLIST

- ☐ Check pindeck level, Tolerance for the pindeck crosswise tilt .040, lengthwise tilt .187,
- ☐ Check machine height, frame should be 18 7/8" to 19" above the pindeck, note the measurements for reference.
- ☐ Adjust the sweep cam levers SA and SB with the 2748 tool, make sure you crank the sweep cams so the flat side of the cam is facing the cam lever roller, the small side of the gauge should not make the switch click, the large side should make the switch click.
- ☐ Adjust the SB cam (middle cam) for the 1st guard stopping point.
- ☐ Adjust the SA cam (LH cam) for 2nd guard stopping point.
- ☐ Adjust the sweep cam lever SC with the 2748 tool, make sure you crank the sweep cams so the flat side of the cam is facing the cam lever roller, once adjusted turn the adj bolt in an additional ½ turn.
- ☐ Inspect all sweep components, links, bushings, rod ends, bolts, brackets, shock mounts, etc… for problems, correct as required.
- ☐ Tighten the crank arm bolts and 3162 rod bolts, Measure the length of the 3162 rod bolt center to bolt center, note the length but do not adjust at this time. (Minimum length is 10 1/8") **Measurement**________



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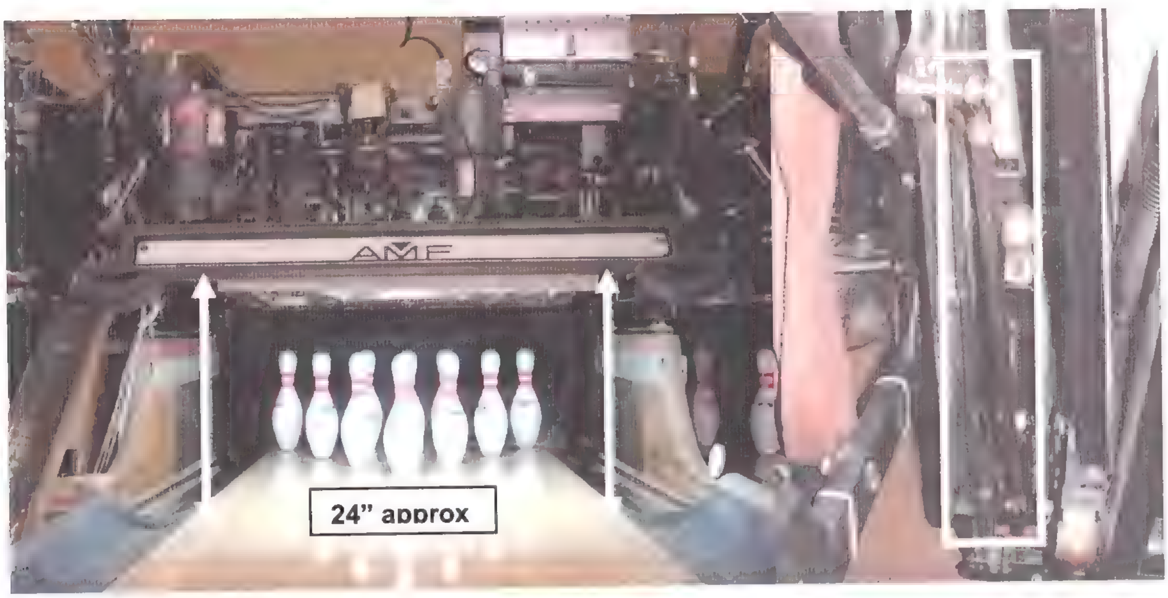
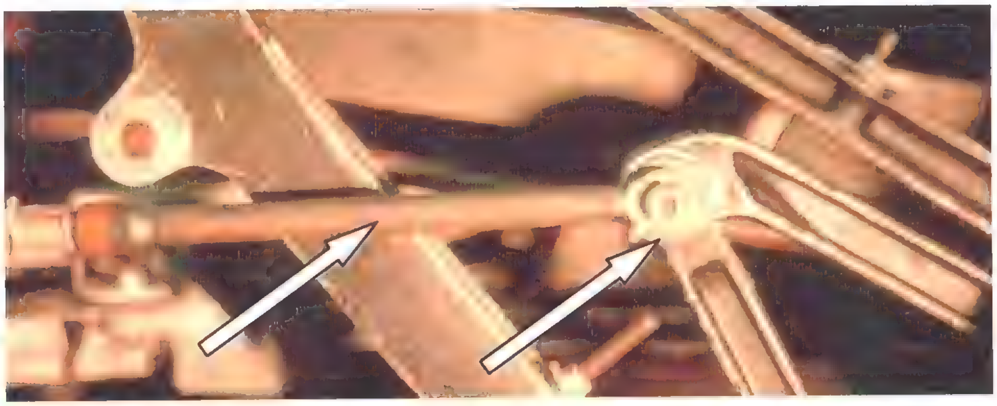
- [ ] Check the stabilizing link bumpers, they should be the same thickness and should not be sticky.

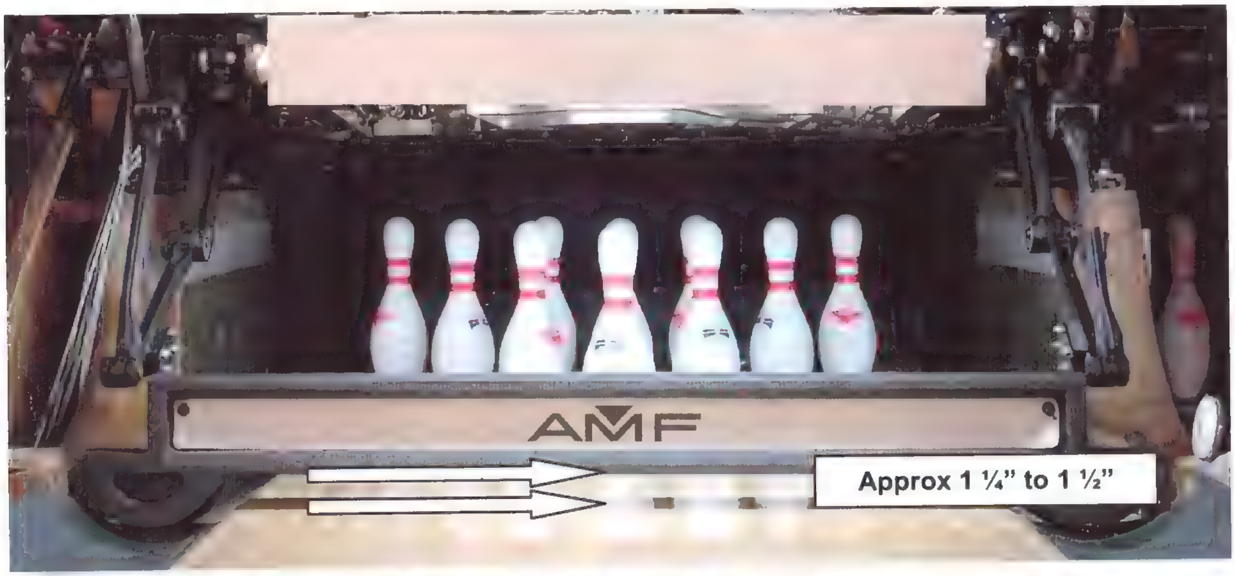
- [ ] Adjust the sweep height at the home position using the 3116 rods, the bottom of the sweep bar should be approximately 24” off the lane, the sweep should be the same height on both sides.

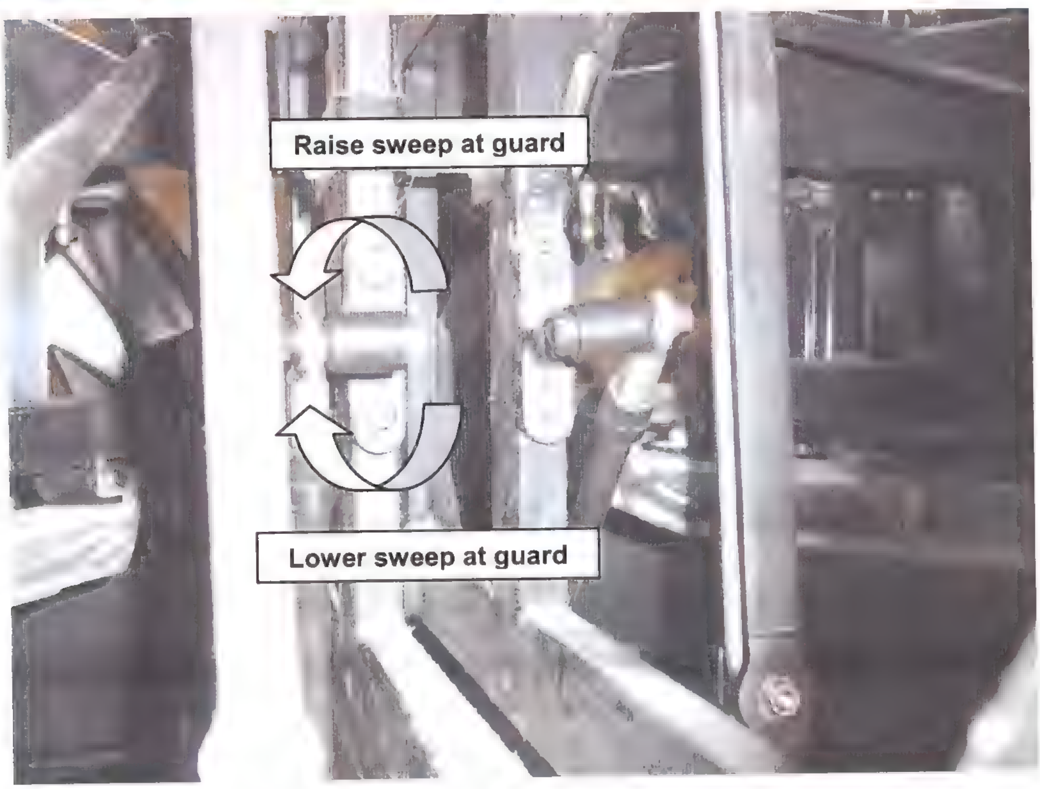


- [ ] Make sure the telescoping inner rod and outer tube are tight on the rod ends.



- [ ] Crank the sweep to 1st guard position, check for 1 ¼" to 1 ½" between the bottom of the sweep and the lane surface, adjust this height with the 3223 threaded link, CCW raises the sweep, CW lowers the sweep. (The 3116 rod can override this adjustment)





- [ ] Note: The long rods 3116 can override this adjustment if it is too short.

- [ ] Crank the sweep to the 4-5-6 line, adjust the sweep height over the pindeck to approximately 5/16", adjust this height using the 3222 bracket on the side frame, move the bracket down to raise the sweep, move the bracket up to lower the sweep. Slightly loosen the bolts and tap the bracket with a hammer. (In some cases washers may be added to the telescoping rod obtain the correct adjustment)

3222 bracket bolted to the frame   3223 threaded link

- [ ] Crank the sweep so it is fully rearward at the 7-10 line, at this point the sweep bar should just touch a pin placed on the back edge of the pindeck. If the sweep knocks the pin off shorten the 3162 rod, (Do not adjust the 3162 rod so it is less than 10 1/8" or the rocker shaft may hit the table gearbox) if it is too far away lengthen the 3162 rod. Adjusting the 3162 at the 7–10 line will change the home position adjustment. Shortening the rod will raise the sweep at home position; lengthening the rod will lower the sweep at the home position. This is generally not a problem as long as the sweep does not hang too low or crash into the machine frame.

- ☐ Thoroughly **clean and lubricate** all sweep components, framework, shafts, rods and rod ends.
- ☐ **MAKE SURE ALL ROD END JAM NUTS ARE TIGHT !**
- ☐ **MAKE SURE ALL NUTS AND BOLTS ARE TIGHT !**
- ☐ Have the instructor check your work.

SWEEP GEARBOX REMOVAL

- ☐ Unplug the sweep motor.
- ☐ Crank the sweep to the 2-3 pinspot line, 7-10 line for machines with sweep counterbalance springs. This puts the sweep in a neutral position.
- ☐ Remove the three bolts that hold the gearbox to the frame.
- ☐ Remove the gearbox, thoroughly clean the gearbox and framework, inspect the output shaft splines and the sweep shaft splines.
- ☐ Insert a motor crank into the motor, crank the motor 20 full turns. This will move the wear pattern of the internal gear train and worm gear to a different location.
- ☐ Apply anti-seize compound to the splines.
- ☐ Re-install the gearbox, put the bottom rear bolt in first, and install all bolts prior to tightening. Fill gearbox oil to the proper level.

SWEEP SHAFT REMOVAL AND REPLACEMENT

(Refer to page 15 in Parts section)

REMOVAL

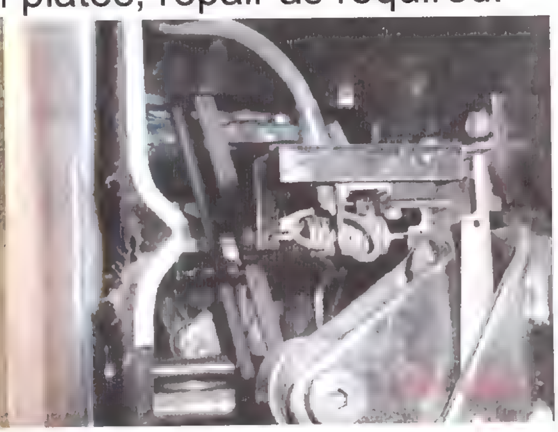
1. Loosen clamp stud; item 15, in SA and SB-SC cams. Tap studs to free cams, cranks sweep to first guard.
2. Remove bolt; item 40, from 3162 rod at end of crank arm.
3. Locate setscrew in locking collar of bearing, item 20, at right end of sweep shaft, loosen setscrew, locate hole in collar-use punch and hammer to rotate collar freeing it from bearing race.
4. There may be a bearing at motor end of the shaft; it will have a locking collar that must be loosened. This bearing is no longer used. A shaft plate, item 32, has been used since serial number 114698. The bearing at motor end of shaft can be removed and shaft plate 070-006-765 used in its place.
5. Sweep shaft, item 29, can now be removed by pulling to right on crank arm, item 28.
6. Loosen bolt; item 39, in crank arm. Slide arm from shaft, remove key, item 30, from shaft.

REPLACEMENT

1. Insert key, item 30, into shaft. Key must fit tight. Slide crank arm, item 28, on shaft over key until shaft is flush with outside edge of crank arm. Tighten bolt, item, 39.
2. Slide shaft through bearing, item 20, about six inches. Slide bearing collar on shaft. (Eccentric side of collar toward bearing) install SB-SC cam, item 26, on shaft, then SA, item 27.
3. Splined end of shaft should be coated with anti seize compound. Slide shaft into motor. Splined end of shaft should extend approximately 1 11/16" to left of shaft plate.
4. Move bearing collar to right over bearing race, then rotate with punch and hammer until tight. Tighten setscrew.
5. Reconnect # 3162 rod to crank arm. Crank sweep through to make sure crank arm clears bearing retainer bolts and rocker shaft.
6. Adjust sweep cam levers and sweep cams per service manual page 5.18.

PIT CUSHION ADJUSTMENT / WORK CHECKLIST

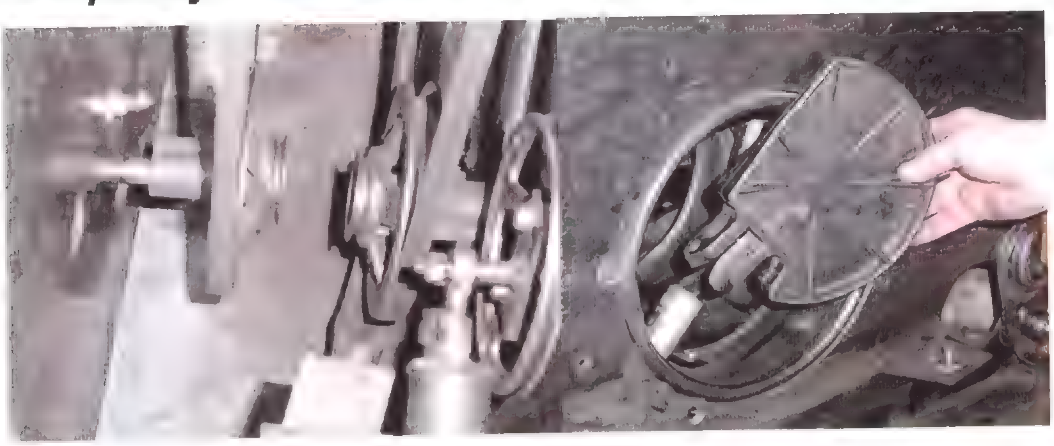
- ❑ Run all the pins into the bin assembly.
- ❑ Drop the sweep to the guard position.
- ❑ Remove the cushion shock lower connection to the cushion weldment.
- ❑ Disconnect the pin curtain, check the urethane grommet for the curtain rod.
- ❑ Remove the three bolts from the cushion hanger bracket on the ball exit side.
- ❑ Swing the cushion forward to disengage the cushion weldment from the opposite hanger box, make sure the round metal plates are in the hanger boxes.
- ❑ Remove the cushion from the machine.
- ❑ Check for broken / worn parts, replace as required.
- ❑ Check for proper washers under the heads of the cushion plank to weldment bolts, tighten all bolts.
- ❑ Remove the cushion shock, remove the shock spring and check the shock absorber function, replace the shock if it has no shock absorbing properties.
- ❑ Reinstall and adjust the shock spring to 6-1/4".
- ❑ Inspect the start switch assy; check for loose connections, bare wires, and broken plates, repair as required.



- ❑ Reinstall cushion shock on start switch mechanism.
- ❑ Begin work on Pit carpet assembly.

PIT CARPET ADJUSTMENT / WORK CHECKLIST

- ❑ Mark your pit carpet with an arrow indicating direction of rotation.
- ❑ Remove belt from carpet drive pulley.
- ❑ Loosen bolts on carpet drive pulley on the rear roller, slide the pulley off the shaft (it may not come all the way off) ***if the pulley is not free on the shaft tell the instructor.***



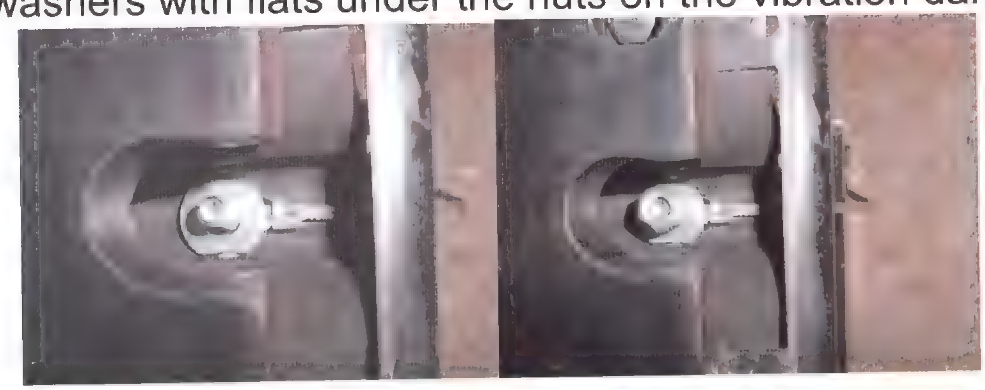
- ❑ Remove the rudder paddle.
- ❑ Push the front roller back and insert the carpet removal pins.

- ❑ Lift the front roller up out of the front roller supports, be careful of the front roller supports.
- ❑ Roll the front roller to the ball exit and pass it through the ball exit.

- [ ] Unlatch the “J” hook retainer for the rear roller, feed the rear roller through the hole in the kickback on the adjacent machine. (You can push the front roller back on the adjacent machine and put bowling pins in between the tailplank and front roller this will make it easier to pass the rear roller out.) The drive pulley can be removed at this time.

- [ ] Remove the 4 nuts holding the bounce pate assembly in the machine, remove the carpet and bounce plate assembly.
- [ ] Inspect the pit assembly, tighten all bolts, check for cracked plows, loose or broken pit supports, idler brackets, remove front roller supports clean, inspect and reinstall, replace any broken parts, clean floor of pit.

- [ ] Inspect the front and rear rollers, remove any belt cords wrapped around the shaft ends, pack the bearings, grease the hinge links, repair as required.
- [ ] Inspect the carpet belt edge, remove loose belt cords or replace carpet belt if required.
- [ ] Inspect the bounce board assembly, tighten bolts, check vibration dampers, check for bonding straps, and repair as required.
- [ ] Inspect Kickback facings for damage and missing rivets, repair as required.
- [ ] Check ball door rings or segments for cracks, repair as required.
- [ ] Check the rudder arm bumpers, the best time to change these is with the bounce boards removed.
- [ ] Install the pit carpet and bounceboard, make sure the bonding straps are installed and there are 5/16" USS washers with flats under the nuts on the vibration dampers.



- [ ] Clean off any burrs on the rear roller drive shaft, put anti seize compound inside the bore of the drive pulley.
- [ ] Install the rear roller; ***put the drive pulley on the end of the shaft before you get the roller all the way in the pit***.
- [ ] Reset the "J" hook for the rear roller, adjust and tighten the rear roller pulley, install the drive belt.
- [ ] Install the front roller through the ball exit, and place in the front roller supports, push back on the roller and remove the carpet pins.

- [ ] Turn on machine and check carpet tracking.
- [ ] Install the pit cushion assembly; make sure the metal disc is in both hanger brackets.

- [ ] Reinstall the lower pit cushion shock to the cushion weldment.

Carpet Tracking spring

- When a carpet belt doesn't track properly we always try to correct the problem in the same way.
- Cleaning bearing supports and freeing them on their pivot studs along with rebuilding the front roller usually takes care of the problem.
- But occasionally no matter what we try we have a carpet belt that just will not track correctly.
- Should this occur, we might want to try using a conical spring on the end of the front roller that we want the carpet to move toward.
- To install a spring the bearing must be removed from the end of the roller. The spring is put in place followed by a protective washer and then the bearing.
- The carpet will track toward the spring. If tracking is over corrected try cutting off a portion of the spring.
- Trim a little at a time off the large end of the spring until tracking is correct.
- 030 007 858 Washer 030 007 859 Spring

82-70 / 90
PROBLEM WITH A BALL IDLING ON THE CUSHION

- When all attempts to eliminate a ball idling against the cushion fail and wear of all components is acceptable there still maybe a cure.
- When an 82-30 vertical lift is converted to a 45-degree lift, a spacer is used between the plank and the hanger weldment.
- The spacer is used only on the ball exit side of the cushion. It is an 82-30 part but can be used on a 70 and may solve the ball idling problem.
- The part number is 030-008-638. A longer bolt is required when using this spacer on an 82-70 machine.
- Part number 808-866-520. The original lower bolt is moved to the upper position.

PIN DISTRIBUTOR

Overview

The distributor transfers pins from the pin elevator wheel to the bin assembly via a continuously moving belt.

Pins are fed to the bin in a predetermined sequence. (1-3-2-4-7-8-5-6-10-9).

The distributor is the same for both right and left-hand machines but a different drive shaft is required for opposite hand machines, odd or RH machines use a shorter drive shaft, even or LH machines use a longer drive shaft.

The distributor belt, used to move the pins, is driven directly by the distributor shaft.

A large nylon distributor cam gear serves a dual purpose in moving the distributor to the various bin locations. The outside cam program causes the distributor to move right and left to the various locations. The inside cam program controls the telescoping action of the carriage. Cam followers ride against the cam profiles causing the movement.

The distributor cam gear is driven by a slip clutch on the distributor shaft. Clutch tension is adjustable, it should only be adjusted tight enough to allow the distributor to operate properly. If the clutch spring is over-tightened, overheating, excessive wear, and poor performance will result.

DISTRIBUTOR CAM TIMING

Proper timing between the cam gear and its drive pinion is essential for proper operation. **The timing adjustment should be checked prior to making any other adjustments.**

The timing is checked at the zero or home position of the distributor. This occurs when the distributor is at the # 1 pin location over the bin assembly. Timing marks on the cam gear are raised bumps on both sides of the gear. Timing marks on the drive pinion are shortened teeth, these marks should face each other at the # 1 position.

The cam is flexible and can be disengaged from the pinion by applying pressure towards the distributor where the cam and pinion meet.

The timing marks can only be checked when the distributor is at the head pin position and the clutch is against the stop blade.

Therefore, this must be the first item to check when you have a distributor problem or improper pin feed will result.

PIN INDEXING

When a pin is dropped on the orientor pan it is carried forward, butt first, on the distributor belt until it is directed into the bin.

As a pin rolls off the front of the distributor, it depresses a pair of trip arms, which disengages the stop blade from the slip clutch. This allows the pinion to rotate thereby driving the cam gear and allowing it to index, the distributor moves to the next position.

The cam gear will makes one tenth of a revolution for each bin location. However, the drive pinion makes one full revolution for each bin location.

The distributor will move only one bin location at a time, each time the trip levers are pressed down and then released. This double stop arrangement allows the pin to roll clear before the distributor moves to the next location.

The index levers cannot be pressed down again until the distributor reaches the next bin location. A cam that is attached to the back of the clutch drive plate assembly accomplishes this. This cam prevents the stop blade from moving down between bin locations. A second purpose for this cam is to allow the distributor to "carry" a pin to the next bin location to avoid misfeeds and pile-ups.

DISTRIBUTOR SUPPORT

The backend of the machine must be level, and set up according to the installation requirements.

There is a special washer on the support shaft for the thrust bearing in the distributor main casting, in some centers this has been removed, in other centers there is more than one washer, leave the support as you found it to avoid potential problems.

The distributor support weldment (or casting) is attached to the elevator wheel cover and the machine cross brace. This support and the mounting shaft should be vertical (plumb). It should not lean to the right or left.

The front of the support may be shimmed to gain the necessary belt guard clearance at the bin (3/8").

In some cases, the shimming of the support may cause the support shaft to come out of plumb, (tilted to the rear) this can cause travel problems around the index pattern.

RELATED OPERATIONAL CONCERNS

Proper adjustment of all distributor components is essential for trouble free operation.

Excessively worn parts must also be replaced. In addition, related assemblies must be adjusted.

Other components that contribute to proper or improper operation include, the pin ejector, pin seating rod, pin guide rail, distributor drive shaft, universal joint, and drive housing.

A smooth operating pin elevator wheel is important to trouble free distributor operation. The ring tube weldment and bearings cannot be rough; these should be cleaned and lubricated per the preventive maintenance program to ensure smooth operation.

The pin elevator wheel should be cleaned regularly to prevent pins from sticking in the wheel pockets, and the distributor belt should be kept free of excessive oil.

DISTRIBUTOR ALIGNMENT

Index the distributor until it is at the #1 pin position. (Distributor Zero)

Inspect the nylon cam gear and pinion to assure the timing is correct.

The distributor should be in line with the #1 bin pocket. If it is not, loosen the rod end jam nut and adjust the tubing accordingly. The distributor will move right or left depending on which way that the tubing is turned.

Operate the machine and note the pin feed at all bin locations. If pins roll Into the #7 pin bin easier than into the #10 pin location, move the distributor toward the ten pin side. Adjust for best pin feed at all bin locations.
In some cases it may be desirable to place a washer between the front rod end of the safety link and its cam follower to gain better pin feed into the # 7 position.

A Safety link is provided to act as a stop should the distributor be jarred out of position. The length of the safety line should not exceed 3" from the lock nut to the rod end to avoid bottoming in the mating tube.

THE DISTRIBUTOR BELT

The belt must be clean and straight.

The distributor belt helps to orient pins as they roll from the elevator wheel onto the distributor.

It also carries the pins to the trip arm assemblies. In time the belt will wear and need to be replaced.

It is also possible for the belt to stretch while in service and become to long before it's worn out. In that case the belt can be cut to length.

The best place to check the belt length is between the tracking bracket and the front casting or the distributor.

A new belt lacing installed and placed back into service for the remainder of its useful life. In either case, worn out or to long, the belt will have to be removed from the distributor.

DISTRIBUTOR BELT REPLACEMENT

Index the distributor to the head pin. Stop the back end motor when the belt lacing is easily accessible. Remove the POWER PLUG.

Remove the belt tensioner spring. Locate belt lacing and remove belt pin. The belt can now be pulled from the distributor.

The approximate belt length is 116-1/4 + or – 1/4inch. Rough top belts are cut one inch longer. Belt length is measured without lacing.

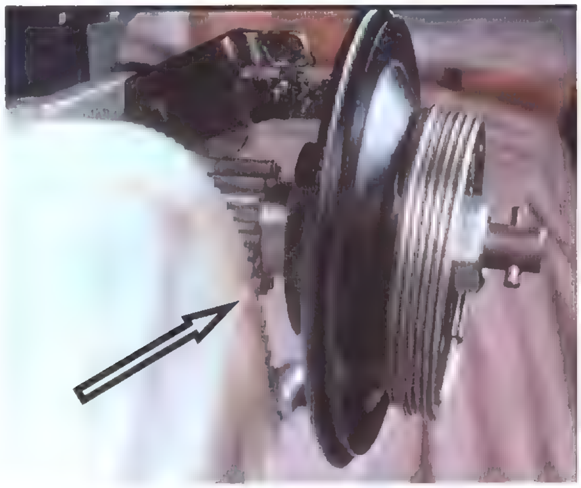
Belt tensioner spring length will increase only one-half of the amount cut off the belt. (If one inch is cut off the belt, spring length will increase one-half inch.)

Use a clipper belt lacer to install new lacing clips to belt.

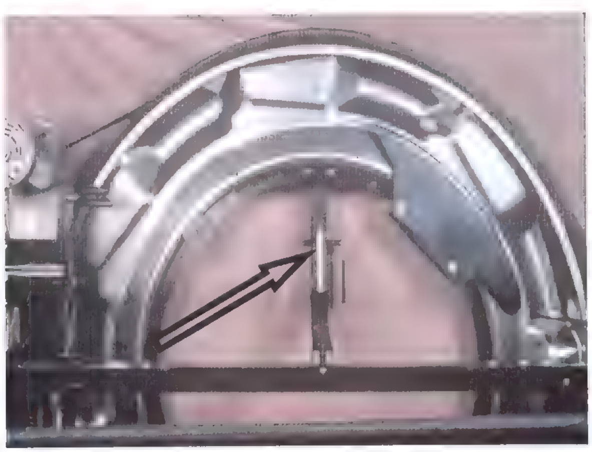
Check condition of the tracking bracket and bearings. Then install the belt and check for proper operation.

DISTRIBUTOR ADJUSTMENT / WORK CHECKLIST

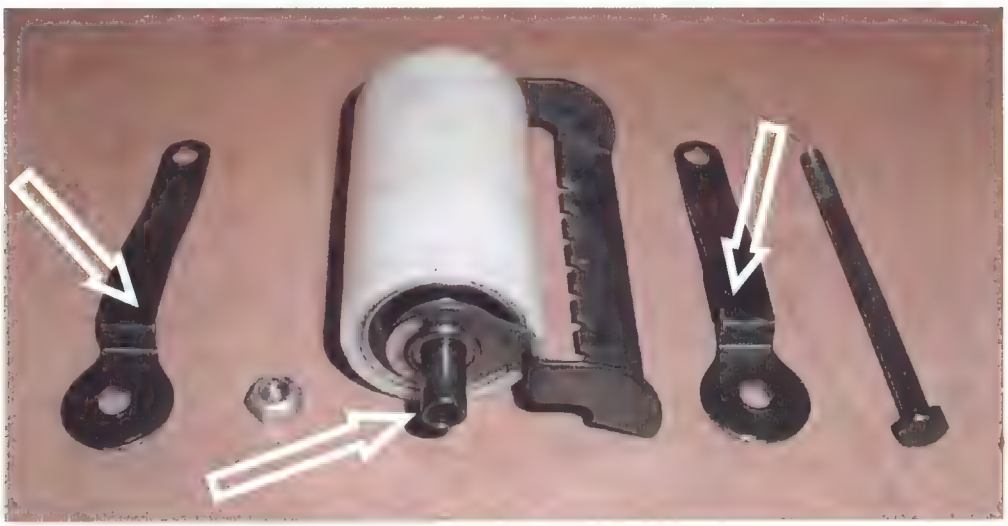
- ❑ ***Run the distributor and observe its operation, make notes on problems and possible parts prior to working on the distributor.***
- ❑ ***CHECK DISTRIBUTOR TIMING, with the distributor at the at 1 pin.***



- ❑ Inspect the drive shaft, shaft should be straight no bends, does not bottom in drive housing, washers, balls, retainer intact, the drive housing should not be worn, can be swapped with next lane.
- ❑ **Remove the distributor.**
- ❑ **Check and make sure the shaft is tight in the support and the spacer is on the shaft.**

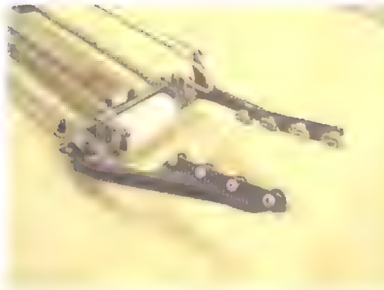


- [ ] **Install the distributor.**
- [ ] Check the distributor support to make sure it is plumb.
- [ ] Mark the distributor belt with an arrow indicating direction of rotation, remove the distributor belt and check for proper belt length 116 ¼ +/- ¼, Rough top 117 1/4 +/- ¼.
- [ ] Clean the entire distributor, replace parts as needed.
- [ ] Pack the tracking bracket belt roller ball bearings with heavy grease to aid in carriage extension;
- [ ] Check for the proper spacer in the tracking bracket tube, check the legs for wear from the belt lacings.

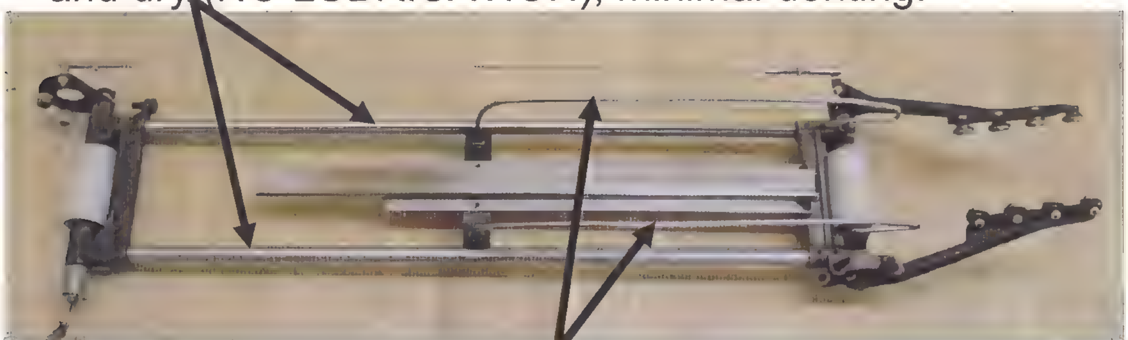


- [ ] Reinstall the tracking bracket.
- [ ] Reinstall the distributor belt; be sure to go through the belt guard.

- [ ] Check trip levers, they should be even in height and parallel, any missing bearings or stop bumpers should be replaced.

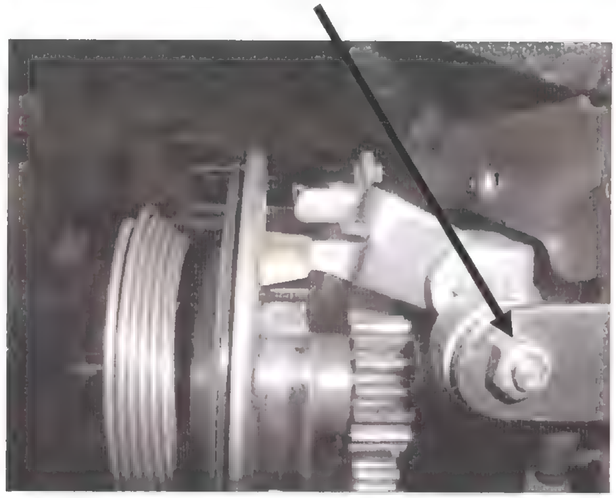


- [ ] Check the carriage tubes, they should be straight, clean and dry (NO LUBRICATION), minimal denting.

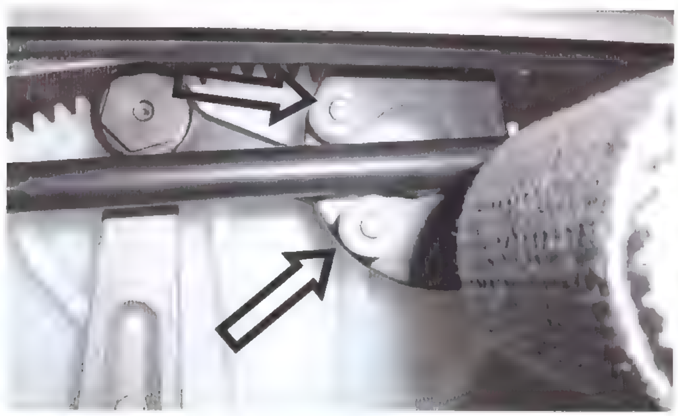


- [ ] Check the front carriage guide rails, they should be tight.
- [ ] Check for the retaining washer on the end of the trip rocker shaft.

- [ ] Check the trip stop rod attachment to the trip stop rod casting, the trip rod casting pivot bolt and spacer should be tight.



- [ ] Check the trip rocker rollers make sure they are not worn.



DISTRIBUTOR ECCENTRIC AND CONCENTRIC ROLLERS

The purpose of the eccentric rollers is to adjust the carriage parallel with the trip rod.

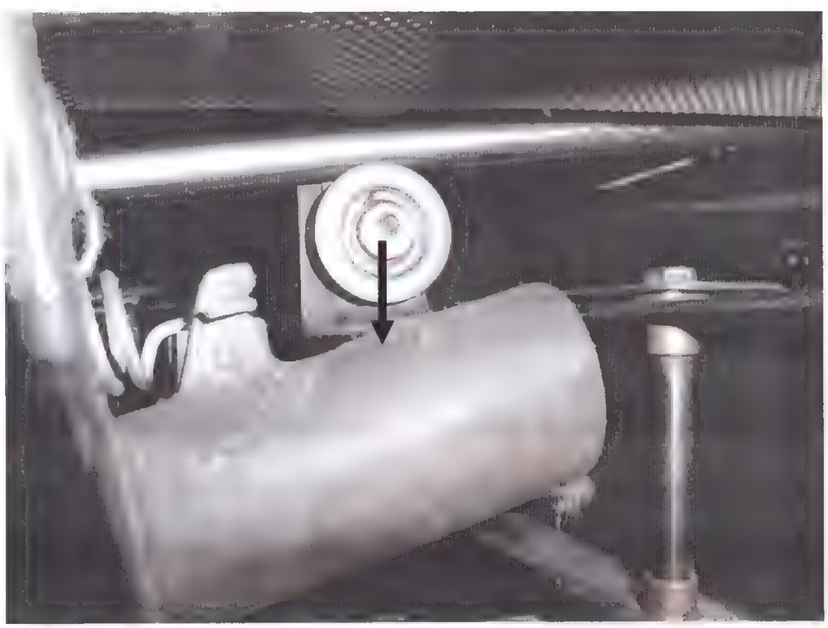
The concentric rollers are not adjustable.

These adjustments will be easier if you *slightly* loosen the 1/4" bolt and use a 1/2" open end wrench to move the eccentric rollers.

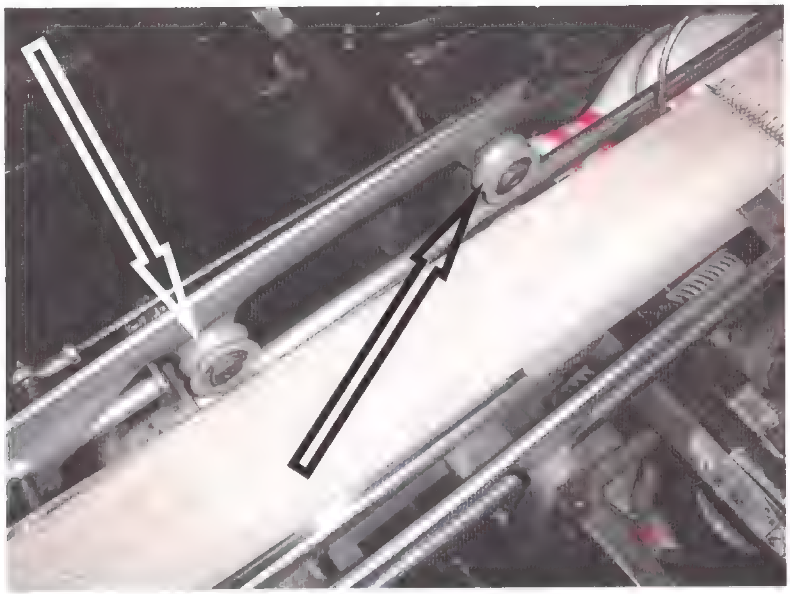
Rollers must be smooth, free of dents or scratches, the bearing must spin freely.

The distributor must be at the "HOME" (1 pin) position.

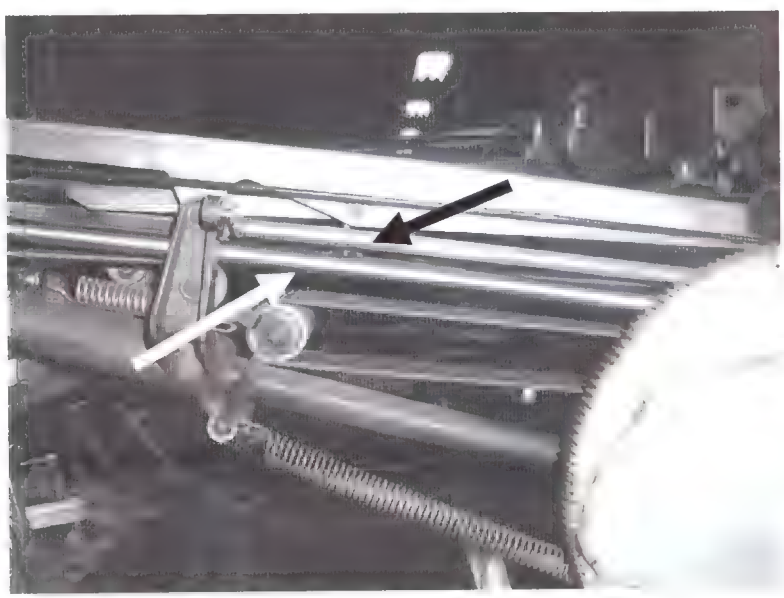
- ❑ Move the carriage so it is fully retracted.
- ❑ Adjust the ***front lower*** eccentric roller down until it is at its lowest point.

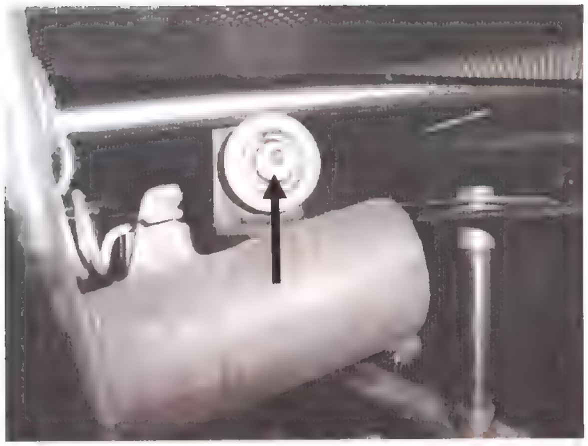


- [ ] Adjust the ***top rear*** eccentric roller down until the roller has a slight amount of drag against the carriage tube. Too much drag could prevent the carriage from extending. Too little drag (too much clearance between the roller and the tube) can allow the distributor to index its self when the carriage extends.

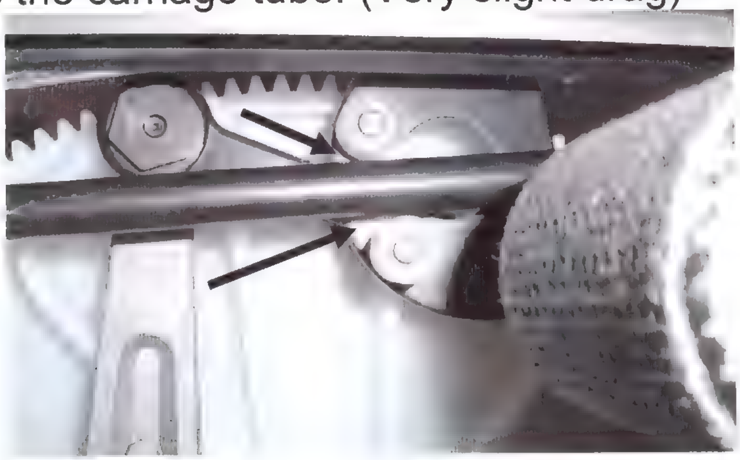


- [ ] Adjust the ***front upper*** eccentric roller until the carriage tubes and trip rod tube are parallel to one another.





- [ ] Adjust the ***front lower*** eccentric roller up until it just touches the carriage tube. (Very slight drag)



- [ ] Adjust the trip cable so that the clearance between the upper and lower nylon rollers and the trip rod tube is equal about 1/16”. If the carriage tubes and trip rod tube are parallel, this clearance will be the same when the carriage is extended as it was in the retracted position.

You can spot check this adjustment by observing the clearance between the nylon rollers and the trip rod as you move the carriage in and out when the distributor is at the #1 position.

If the carriage and trip rod are not parallel, the release point of the trip arms will change as the distributor moves over the bin. In some cases the distributor may not index.

- ❑ Remove & Replace clutch, clutch components should be **CLEAN and DRY**. Pinion and sleeve lubricated, sleeve should protrude beyond the pinion bushing slightly,1 turn on spring to start. **(your hands must be clean)**
- ❑ Check orientation pan adjustment, ¼" away from pinwheel.
- ❑ CHECK DISTRIBUTOR TIMING, at 1 pin.
- ❑ Check the safety link adjustment at the 1 pin, safety link inner rod should have no more than 3" exposed, safety link spring tab must be straight and 90^0 to uniball.
- ❑ Check the safety link spring make sure it does not touch support or safety link.
  Add washers between safety link uniball and lateral cam follower to gain 7-10 swing if needed.
- ❑ Check for proper height above the bin, 3/8" (belt guard should just clear the bolt for the bin switch lever).
- ❑ **RUN DISTRIBUTOR WITHOUT PINS, CHECK FOR PROPER OPERATION.**
- ❑ Run the machine with pins in a constant cycle for no less than one hour, correct any problems that may occur.

BALL LIFT / WORK CHECKLIST

- ☐ **Drop the sweeps on both lanes, run all pins to the bin assembly, remove power plug from both machines and lock out, remove lift guard and back end guard.**

LIFT REMOVAL

- ☐ Remove springs from belt tensioner assembly.
- ☐ Remove ball lift drive belts from lift pulleys and rudder drive belt from tensioner (careful of spring tension).
- ☐ Remove clamp studs from upper and lower ball lift shaft mountings.
- ☐ Lift the ball lift up out of brackets.
- ☐ Inspect lift belt and drive belts.

LIFT REPAIR

- ☐ Inspect upper and lower link assemblies. Clean and lubricate shafts and bearings. Check shock absorber.
- ☐ Reduce belt spring tension and remove belt.
- ☐ Inspect upper and lower shafts. Clean and lubricate one way clutches and bearings.
- ☐ Inspect pulleys. Replace any worn parts in lift.
- ☐ Reassemble lift. All setscrews must be against flat side of shaft. Check one way clutches for direction of drive.
- ☐ Adjust belt tension spring to 4" - 41/2" overall length (starting measurement).

STARTER PAD

- ☐ Inspect rubber starter pad, shaft, bolt and flange bearings. Replace worn parts.
- ☐ Starter pad assembly should be in line with track weldment and centered between the kickbacks.
- ☐ Check track support weldment for loose bolts. or being bent.
- ☐ Replace track covers if worn or cracked.

BALL EXIT KICKER ROLLER LIFTS

- ❑ Check front and rear segments for cracks, tighten all bolts.
- ❑ Check front and rear fillers for cracks, center the fillers between the kickbacks.
- ❑ Check the rear filler bumpers for the kicker rollers, one edge should be trimmed to avoid contact with the kicker shaft.

BALL EXIT PBL

- ❑ Check ball door rings for cracks, tighten all bolts.
- ❑ Center lower portion of the track rail between the kickbacks, make sure there is a flat washer or shakeproof washer between the bolt head and the slot in the bracket.
- ❑ Check the clearance between the curved lift arm and the kickback, it should be approximately 1/8" away from the kickback, adjust as required by adding or removing washers between the curved arm and the lift arm.
  (note) the lower track rail bracket must be removed from the machine to make this adjustment.
- ❑ Adjust the #11049 rod to obtain the 1/8" height of the lift arm above the ball door rings.

RACHET WHEEL AND LIFT ARM

- ❑ Inspect all rollers, replace any that are missing, swelled, etc....
- ❑ Check the drive mechanism for freedom of movement and spring return, bumpers etc.....
- ❑ Check For the proper amount of washers on the lift arm and ratchet wheel, use the table on the next page.

DRIVE BELTS

- ❑ Inspect all belts replace those worn or cracked

BELT TENSIONER ASSEMBLY

- ❑ Inspect the arms, pulleys, retaining rings, correct as required.

Proper spacing of the PBL lever arm and Ratchet wheel

1. Measure the distance between the metal kickback plates directly in front of the ball door opening.

2. Following the table below select the width between the kickbacks and install the proper amount of washers to correctly align the lift arm and ratchet wheel. Each washer is 0.065" thick.

Inside width	Lever arm washers	Ratchet washers
9 1/8"	0	1
9 ¼"	1	2
9 3/8"	2	3
9 ½"	3	4
9 5/8"	4	5
9 ¾"	5	6
9 7/8"	6	7
10"	7	8
10 1/8"	8	9
10 ¼"	9	10
10 3/8"	10	11
10 ½"	11	12
10 5/8"	12	13

KICKER ASSEMBLY

Removal and Repair

- ☐ Remove springs from idler arm assemblies. Remove and inspect belts.
- ☐ Remove 3/8 nuts and washers from roller base.
- ☐ Bring kicker assembly out back of machine. Remove kicker rollers.
- ☐ Inspect, clean and lubricate all shafts and bearings. Replace worn parts.
- ☐ Reassemble kicker.
- ☐ When replacing kicker rollers, set screws must be against flat side of shaft.

Replacement

- ☐ Inspect kicker support brackets. Tighten, straighten and align as needed.
- ☐ Install kicker assembly between kickbacks on support brackets. Center kicker assembly between machines, kicker rollers should be between 1/16" and 3/16" from kickbacks. Replace nuts and washers.
- ☐ Washers are used to move roller brackets in or out to accommodate different distance between machine. Move washers from between roller brackets to outside of brackets to move kicker roller away from kickback or from outside of brackets to between brackets to move kicker roller closer to kickback. Idler arm assembly washers should be moved the same as roller assembly washers to assure belt alignment. Kicker assembly must be out of machine to move washers. (See note 1)

LIFT REPLACEMENT

- ☐ Position upper and lower lift shafts in brackets on kickbacks. (Drive belts must be in place around lower link before clamp studs are inserted.)
- ☐ Insert and snug clamp studs. Lift must be in line with track weldment. Move lift left or right to obtain proper alignment. Use adjustable shaft plates to help alignment if needed. (See note 2) tighten clamp studs when alignment has been obtained.
- ☐ Place a ball under lift and adjust shock nuts or rubber bumpers, depending on the installation, so the bottom of the ball lift belt touches the ball.
- ☐ Check all belts for alignment and tension. Align and adjust as needed.
- ☐ Check lift operation. If the ball enters the exit but idles at the bottom, adjust lift downward. If the ball won't enter the lift, adjust the lift upward, or check kicker roller placement and belt tension.

BALL LIFT BELT TENSION

- ☐ Rotate the spring retainer to compress spring between 41/2" and 4" overall length. If the lift belt rubs against the tube assembly when the ball is being elevated, adjustment of the compression spring is necessary. The smaller the spring, the greater the belts tension.

LIGHT BALL SENSOR ADJUSTMENTS

- ☐ Inspect and clean the LBS, replace any worn or defective components.
- ☐ Adjust LBS so it is centered between the machines using the mounting brackets.
- ☐ Move the reset cams outward as far as they will go.
- ☐ Push the trip rollers forward and adjust the trip cam so there is 1/8" clearance between the rollers and the trip cam on both sides.
- ☐ Adjust the crank pulley so it is at its minimum stroke.
- ☐ Adjust the LBS link to obtain equal stroke side to side.
- ☐ Adjust the crank pulley so the rudder arm touches the bumpers on the kickbacks that are next to the ball door.
- ☐ Adjust the reset cams so they will push the trip rollers back forward, this should cause the gap between the reset cam and trip roller to close slightly.

RUDDER ARM ASSEMBLY HYDRAULIC

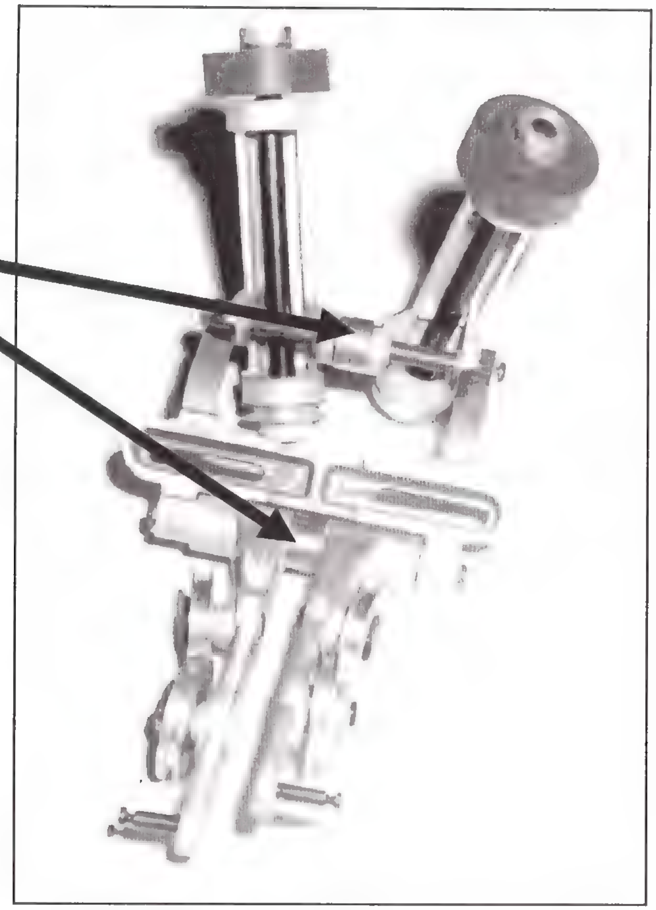
- ☐ Check for free movement of rudder arm from one rubber bumper to the other. Center and align as necessary.
- ☐ Inspect drive link and bearings. Check for special step washers at drive link bearings. Low side of washer toward bearing.
- ☐ Adjust rudder drive crank plate so piston shaft moves ¼" to ½" into or out of the body of drive link after rudder arm strikes bumper at kickback resulting in an approximate delay at the bumper of 1.5 seconds.

(Note 1)

Move washers from between roller brackets to outside of roller brackets to move kicker roller away from kickback.

Move washers from outside of roller brackets to between roller brackets to move kicker roller closer to kickbacks.

Idler arm assembly washers should be moved the same as roller washers assembly washers to assure belt alignment.

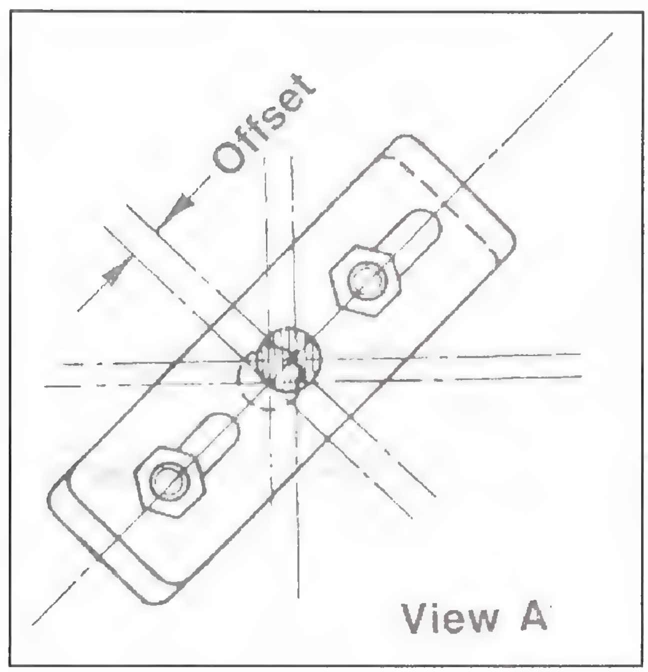


(Note 2)

Adjustable ball lift support shafts are provided to allow alignment of the ball lift to the track rails.

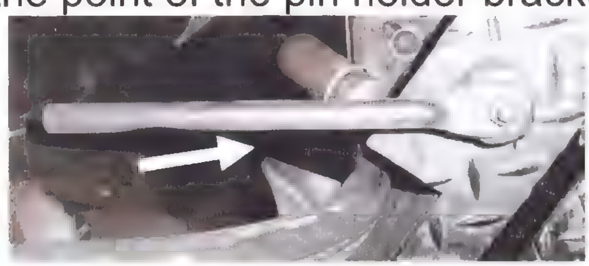
Adjustment is required when the shaft supports on the metal kickback assemblies are not aligned.

Alignment is achieved by turning plates on the support shaft assemblies till the plates are parallel to the direction of offset. (See view A)



PIN ELEVATOR ADJUSTMENT / WORK CHECKLIST

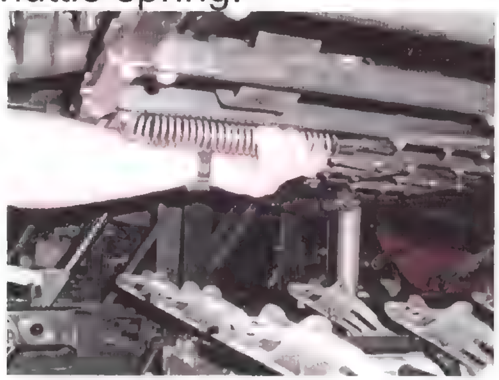
- ❑ Listen to elevator check for any rumbling noise, this may be an indication of a chattered ring tube.
- ❑ Remove the upper ring tube bearings one at a time, clean and inspect for wear and rough bearings. You must support the elevator wheel to remove the upper bearings.
- ❑ Remove the lower ring tube guide bearings, clean and inspect for wear and rough bearings, leave bearings out and move to the next step.
- ❑ Remove the ring tube lubrication wick and spring, replace if needed, cut the wick into a "Y", reinstall the wick and spring, and fill the reservoir with way oil.
- ❑ Check the 7 ring tube attachment bolts and pin holder bracket bolts for tightness.
- ❑ Check the elevator wheel belt, replace if necessary.
- ❑ Check the elevator belt tensioner, the arm should move in and out, the wheel should rotate.
- ❑ Check the pin guide rubber mounts for cracks.
- ❑ Check the diamond step plates for loose or missing hardware, correct as needed.
- ❑ Check the adjustment of the pin seating rod, it should be ½" away from the point of the pin holder brackets.



- ❑ Check the operation and adjustment of the pin ejector, it should be at a 90^0 angle to the kickback, the rear edge of the roller should be between the back edge of the plow and front edge of the elevator wheel, it should have free upward and downward motion without binding.
- ❑ Clean all elevator components.

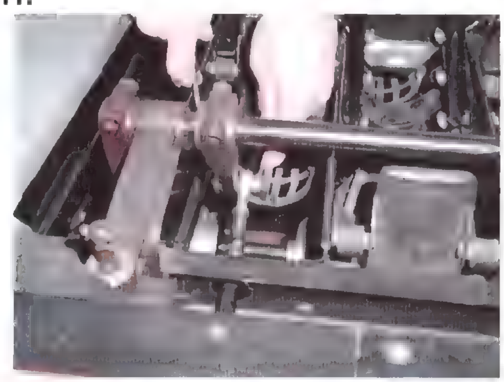
BIN & SHUTTLE ADJUSTMENT / WORK CHECKLIST

- ❑ Check the clearance between the shuttle stop bolt and block, note the clearance. A quick check for this is to observe the shuttle forward movement as the table starts to feel for pins.
- ❑ Run all pins into the pit, drop the sweep, lockout the machine.
- ❑ Remove the distributor, place the distributor on the bin of the opposite lane.
- ❑ Remove the shuttle spring.



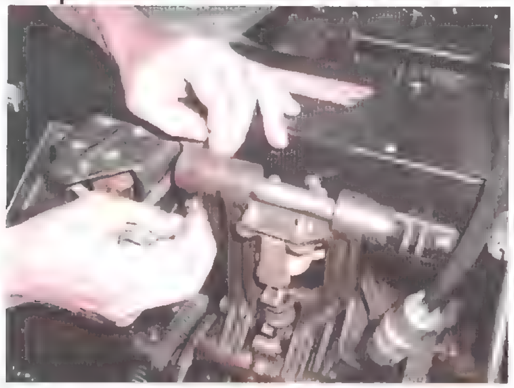
6 1/2
BOLT TO BOLT

- ❑ Remove the bolt that connects the shuttle operating rod to the shuttle arm.

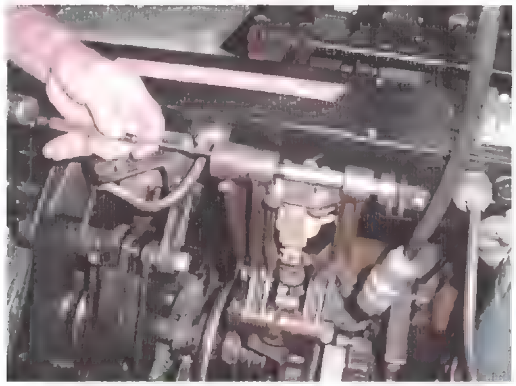


- ❑ Note how the shuttle cam follower bearing rides on the cam, it must be centered on the cam, adjust the cam as needed, there should be no pressure on the cam at this time.

- [ ] Loosen the clamp stud on the shuttle cam follower.

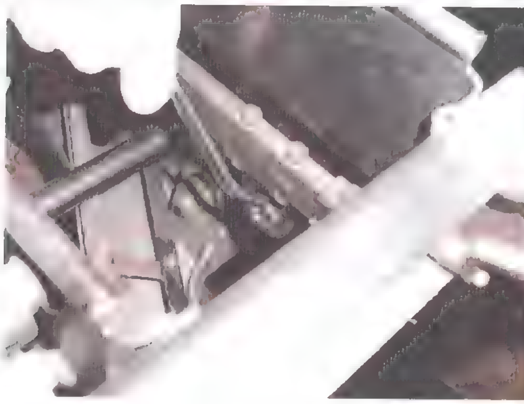


- [ ] Tap the shuttle cam follower shaft towards the right side (10 pin side) of the machine to free the cam follower.

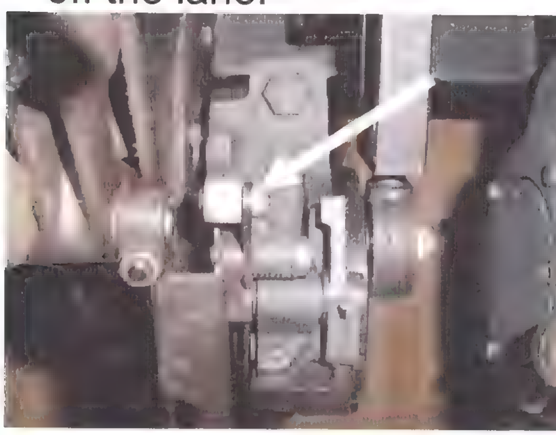


- [ ] Remove the cam follower and operating rod, **do not** disassemble the operating rod until the instructor goes over the details of disassembly, disassemble the operating rod, inspect for problems, correct as needed, reassemble.

- [ ] Remove the front lower shuttle hanger bolts.
- [ ] Remove the rear lower shuttle hanger bolts.

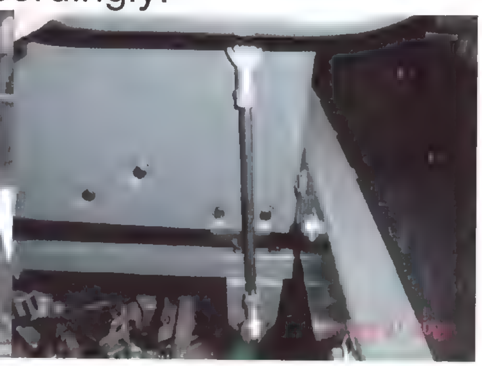
 

- [ ] Hold the table drive latch roller down while cranking the table motor in the normal direction, stop the table about 6” off the lane.

- [ ] Remove the shuttle out over the rear of the machine.

- [ ] Check the shuttle for broken straps, worn pin holder brackets, bent tubes, tighten all bolts, install shuttle straps in all locations except the #1 location, check for hex head bolts etc.. correct as required.
- [ ] Check the shuttle for square.
- [ ] Inspect the bin assembly for problems, broken shock mounts, missing bumpers, cracked butt plates, 1 pin track bearings, stringers, guides, tighten all bolts, etc.. correct as required.
- [ ] Thoroughly clean the bin and shuttle.
- [ ] Reinstall the shuttle, cam follower and operating rod, adjust shuttle stop bolt as needed.
- [ ] Check the shuttle tube and bin stringer alignment, correct as required.
- [ ] Install the shuttle spring.
- [ ] Check to make sure the table is at 355^0
- [ ] Check the shuttle front to rear and height adjustments with the 6519 gauge, adjust accordingly.


- [ ] Install the distributor.
- [ ] Run the machine without pins to ensure the shuttle operates properly.
- [ ] Fill the bin with one set of pins, push all pins forward in the bin, set the machine on 2nd ball and cycle, all pins should shuttle, correct as required.
- [ ] Fill the bin with two sets of pins, put the machine on 2^{nd} ball and cycle, only one set of pins should shuttle.
  BE READY TO SHUT OFF THE MACHINE IN CASE OF A DOUBLE SHUTTLE.
- [ ] Run machine in a constant cycle, observe operation correct as required.

TABLE COMPONENTS

Table motor:
Same as sweep motor except for leads TMP- CT and TMP-Y, these are connected together at TS-13 in the front wireway.

Table shaft:
Imparts motion from table motor to the various table and shuttle components.

Table Spot / Respot Cams:
This multi profile cam controls spotting and respotting functions, each has its own cam follower that rides the cam surface, the cam followers have rods attached to the end that connect to components on the table that actuate the spotting or respotting function.

Respot cam follower:
Transfers motion from the respot cam through the respot rod to the pawl and shifter link assembly to open and close the respot cells as needed.

Spot cam follower:
When the top of this cam follower is latched, it forces the cam follower to ride the cam surface, this transfers motion from the spot cam through the spot rod to the spot lever on the table. The lever on the table performs 2 functions when it moves, first it raises the shifter link assembly to open respot cells if needed, second it rotates the yoke shafts to rotate the yoke shafts and cups from the horizontal to the vertical position for pin spotting.

Shuttle cam / follower:
Allows the shuttle to move forward during a spot cycle if the shuttle stop is unblocked by the spot solenoid.

Table cams and switches:
TA1, runs table to the home position, initiates sweep run home in 5 board chassis.

TA2, initiates sweep run through, initiates sweep run home in a MP chassis.

TB, table interlock switch, in a parallel circuit with SC, removes ground from "T" and "S" relays.

Spot solenoid:
Functions to, latch spot lever, unblock shuttle cam follower, unlatch table drive

Respot solenoid: (older "B" machines)
Functions to allow spotting of pins, replaced by linkage attached to shuttle stop due to issues with residual magnetism.

Spot solenoid spring link:
This link allows the spot solenoid to engage if the spot mechanisms are in a bind or held back; one instance would be the shuttle cam follower in contact with the shuttle stop. During a strike cycle the spot solenoid is energized before the table approaches 355 degrees.
Key wear points: Shaft keys in the spot solenoid shaft.

Table drive:
Functions to allow the table to make the long stroke to spot pins, it is released by the spot solenoid via the shaft and cam.
Key wear points of this assembly are the roll pins in the cross shaft that holds the release lever and the cam ball stud

Table over travel clevis:
This connects the table drive to the table torque tube; it provides a means to adjust table height.
It also provides for actuation of the OFF SPOT switch should the table be held up by an off spot pin.

OS switch:
This switch informs the chassis that an off spot has occurred, the chassis limits the table shaft to one rotation, disables sweep run through, and switches the machine to 2^{nd} ball.

Torque tube:
This transmits the cranking motion of the table shaft and drive, to a vertical motion for up and down motion of the table. The torque tube pivots are mounted under the front wireway. Due to this geometry, as a lane is sanded and the table is re adjusted to compensate, pins will move forward off spot. The table will also be closer to the sweep when the table is at 180 degrees or bottom dead center (BDC).

Table counter balance springs:
These large springs are mounted on the torque tube and the machine frame behind the main wireway, the help raise the table and eliminate table bounce.
82-90 machines use 4 springs, 2 long and 2 short, these compensate for the additional weight of the steel table.

Tie rods:
These turnbuckle rods keep the table parallel to the lane surface. They adjust the front to rear tilt of the table. Lengthening the rods raises the front of the table shortening the rods lowers the front of the table.

Table supports, two types on 70's, two types on 90's:
These connect the torque tube to the table assembly.
The older style have a threaded shaft inside an aluminum casting, this allows for adjustment up and down on either side of the table.
The newer style are a welded steel assembly, by installing shims between the table casting and the table support the table may be shimmed down on the high side.

Table casting:
This is the main frame of the table; all table components are attached to this main casting.
82-90 machines use the steel table.

Yoke:
This assembly holds all the spotting cups on four rotating shafts; these shafts are connected together by the table connecting link (lightning rod) so all rotate the same at the same time, and the shafts act to move the spotting cups from the horizontal to the vertical position. The spot rod and lever imparts this rotation though a slotted pivot located on the front yoke shaft and a bearing located on the spot lever on the table.

Four legs support the yoke, the front LH leg of 82-70 machines and some 82-90 machines with aluminum tables have a large spring attached to it, this spring keeps the yoke in a forward position until it is forced rearward by the spot lever, rod. 82-90 machines with steel table have 2 tension springs attached to the 7-10m yoke shaft to perform this function. The front LH leg also has an adjustment bolt at the bottom; this bolt is used to set the proper "toe in" of the yoke.

Spotting cups:
The ten cups hold the pins during spotting; they must be gauged equally for proper spotting action, It is best to use the same brand of spotting cup in all positions.

Table (yoke) springs:
Three springs mounted on the 3rd and 4th yoke shafts hold the cups in the horizontal position until the cups are turned by the spot lever and rod. They are noted as RH and LH springs (page 37 parts section) due to the way they are wound rather that what side of the machine they are on.

These must be adjusted evenly, too much tension and the cups will slam back to the horizontal position, and insufficient tension will cause unstable movement and result in pins falling over.

Early machines only used two springs on the # 4 yoke shaft.

Shifter link mechanism:
This mechanism is located on the front LH side of the table; it opens and closes the respot cells via input from the respot rod and pawl or the spot rod lever.

Respot cells;
Ten respot cells mounted on the table-casting pick up and respot pins, the action required to operate the cells is transmitted via levers, wireways, and carburetor links mounted on the table casting.

GS switch:
The gripper switch is mounted in the yoke of the respot cell, since there is ten respot cells there are ten GS switches. The GS is spring loaded open. When a pin is picked up the switch closes and grounds the wire for that respot cell, this sends a signal to the chassis via the table harness that a pin has been picked up and what position it is.

If a cell wire comes off and grounds out, the Pinspotter will not go through a strike cycle.

Wireways:
These links are made of extruded aluminum, these connect all respot cells together via levers and links, and they hold the table harness wires.
On newer machines these are simple aluminum angle.

Respot cell pivot studs 1/4" & 5/16":
These pins are a pivot point for cell actuation; each respot cell has one of these pins. The early machines used 1/4" studs (070-002-654) these were susceptible to bending and were replaced by the 5/16" studs (070-007-617).

When upgrading to the 5/16" stud, the bushings from lever 070-007-618 & 620
Must be removed.

#7 cell, bushing upside-down for wireway link
See page 31 in the parts section,
Bushing # 070-002-653 is inserted top down for the # 7 cell, bottom up for the other nine cells.

#7 cell, wire way differences:
See page 29 in the parts section,
Older machines use wireway # 070-002-767, this is connected to the bellcrank using a solid link # 070-002-582, and connected to the # 7 cell using link
070-002-813.

Newer machines use wireway # 070-006-669; this link is connected to the bellcrank using # 070-002-814, with a direct connection to the # 7 cell.

WHY STOP THE TABLE AT 355^0

1. To allow the weight of the table to assist with braking.

2. To avoid having the table coast beyond $zero^0$.

3. To allow for proper shuttling, the table raises up to accept pins from the shuttle.

4. To avoid binds in the spot solenoid linkage

SPOT SOLENOID FUNCTIONS

1. Latch spot lever, to allow the lever to work off the cam and rotate the cups from the horizontal position to the vertical position for pinspotting.

2. Unblock shuttle cam follower so the shuttle can move forward and deposit pins into the table.

3. Unlatch table drive so the table can make the long stroke to the lane surface.

Table adjustments by the "BOOK"

Page 5.29
Adjust table cam levers
Adjust table cams so the table stops at 355 degrees

Spotting solenoid adjustments

Page 5.36
Adjust shuttle stop bolt for .015" clearance from the shuttle stop.
Adjust spot lever latch for .176" clearance above spot lever using the 2748 gauge.

Table adjustments spotting

Notes:
- Pins must be in the cups.
- Check the pindeck level, adjust as required.
- Check machine frame, 18 3/4 to 19" off lane, adjust jackscrews, you must loosen back end attachment bolts prior to adjusting front end.

Page 5.31
Check Left to Right level, adjust with table supports

Check front to rear level, adjust with tie rods # 1558

Check bottom dead center height @ 5/16 + 1/8 - 0 using 6519 gauge, adjust with clevis.

Page 5.32
Crank table backwards until it is 6" off lane

Move the collar on the RH side of the front yoke leg (7 pin side) on the yoke shaft

Place combination square on yoke shaft and table leg bolt shoulder

Adjust the yoke leg screw until bubble move just to the rear and stays at 1/2 bubble. This sets the proper "toe in" so the pins are properly spotted on the toe of the pin.

Move collar back into place and tighten.

Page 5.33
Adjust cup openings to 4 1/8", most mechanic use a rubber mallet to adjust the opening (unlatch spot cam follower so cups are horizontal)

Page 5.33
Crank table forward so the #1 pin base is 5/16" off the lane (use 6519 gauge)

Adjust spot rod to obtain 1/16" between adjusting bolt and stop pad, tighten jam nuts. (Note increasing this gap will move all pins rearward off spot equally)

Adjust spot cups to spot pins.

Inspect respot cell bellcrank over-center spring, plate must be straight and the spring attached at both ends.

Table spring adjustments

Page 5.38
Three springs mounted on the 3rd and 4th yoke shafts hold the cups in the horizontal position until the cups are turned by the spot lever and rod.

These must be adjusted evenly, too much tension and the cups will slam back to the horizontal position, and insufficient tension will cause unstable movement and result in pins falling over.

Early versions of the Pinspotter had only 2 springs located next to the # 7 & 10 spotting cups.

Table alignment (flagging)

Always make sure you set the front to rear and side to side level (or parallel to the pindeck) and height over the pindeck at BDC before you check the table alignment with the flags.

If the table is not at the correct height the flags will show improper alignment.

TABLE PHASE 1 ADJUSTMENTS

TABLE GEARBOX REMOVAL

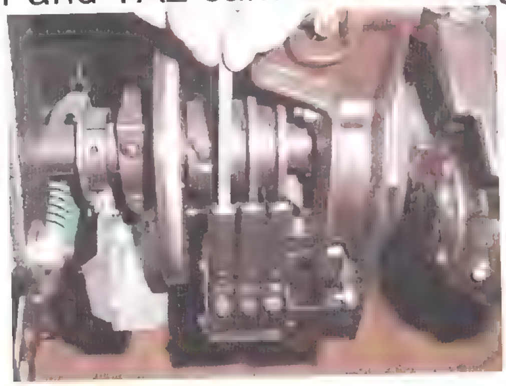
- ☐ Unplug the table motor.
- ☐ Crank the table to BDC, support the table on a block of wood.
- ☐ **If** your machine does not have a shaft support bearing next to the gearbox, **it may be necessary** to remove the respot and spot lever tension springs
- ☐ Remove the three bolts that hold the gearbox to the frame.
- ☐ Remove the gearbox, thoroughly clean the gearbox and framework inspect the output shaft splines and the table shaft splines.
- ☐ Insert a motor crank into the motor, crank the motor 20 full turns. This will move the wear pattern of the worm gear to a different location.
- ☐ Apply anti-seize compound to the splines.
- ☐ Re-install the gearbox, put the bottom rear bolt in first, install all bolts prior to tightening. Fill gearbox oil to the proper level.

TABLE PHASE 1 ADJUSTMENTS CONT.

- ❑ Run all of the pins into the pit, turn off pit switch
- ❑ Inspect cams, levers, bearings, table drive, spot solenoid, shafts, nuts & bolts, etc.. for problems
- ❑ ***Check the roll pins, shaft, cam ball stud, and bushings for wear and broken roll pins on the table drive latching mechanism.***
- ❑ ***Push up on the spot solenoid, at the same time pull up on the table drive release lever , make sure the release lever stays down and locked***

- ❑ Check the shuttle stop block and table drive release lever for slop in the keyway.

☑ Adjust the TA1 and TA2 cam levers using the 2748 gauge



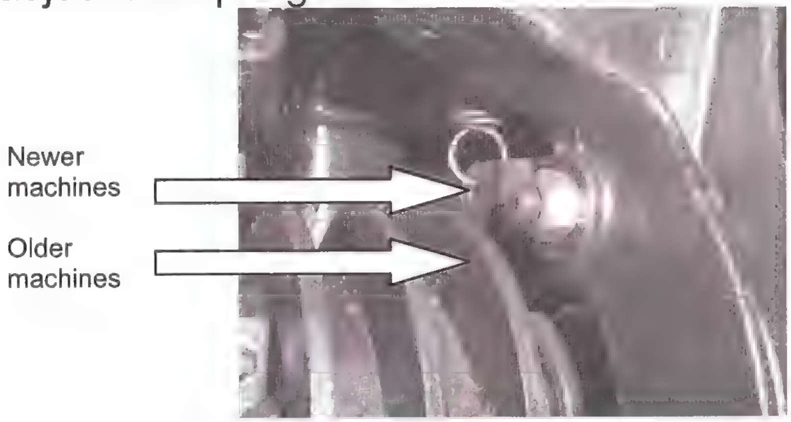
☑ Adjust the table cams to obtain the correct 355' stopping position (TA1 controls the 355^0 stopping position)

☑ If the gap is too big, retard the cams, if the gap is too small, advance the cams

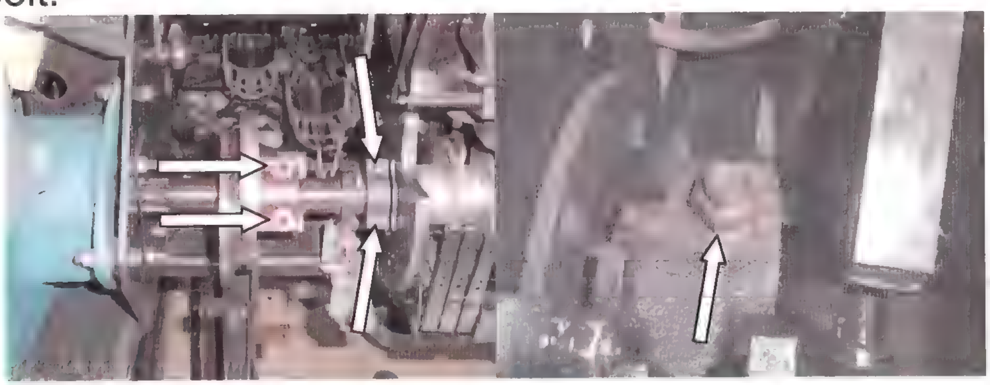
☑ Adjust the TB cam lever with the 2748 gauge with the flat surface of the cam facing the arm, then adjust the bolt in an additional ½ turn, tighten the jam nut.

☐ Adjust spot lever latch for .176" clearance above spot lever using the 2748 gauge, use the jam nuts to set the proper gap.

- [ ] Check the spot solenoid spring tab alignment, the hole for the spring should be at the same height as the center of the bolt. Note: machines with the respot solenoid conversion adjust the spring tab so the hole is 3/8" below the bolt.



- [ ] Tighten Spot / Respot cams, Shuttle cam, and Table drive bolt.



- [ ] Remove the stop bolts from behind the spot / respot levers

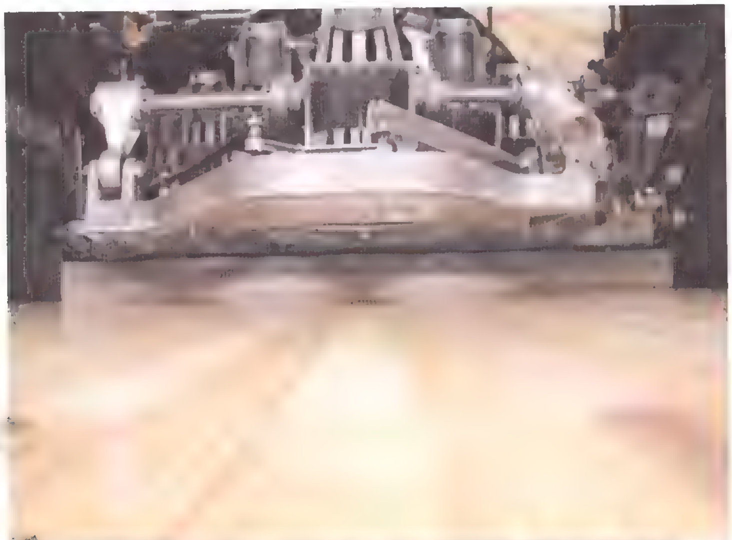
- [ ] Thoroughly clean the entire front end, lubricate cam follower bearings and cams (everything you can reach)

- [ ] Have instructor check your machine.

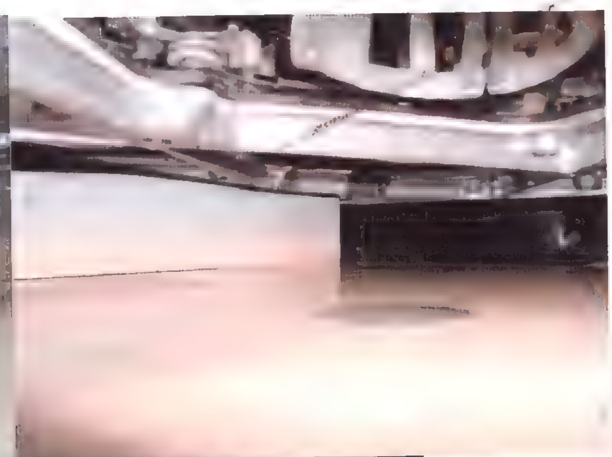
TABLE PHASE 2 ADJUSTMENTS

- ☐ Run all of the pins into the pit, lock out machine.
- ☐ Inspect cams, levers, bearings, rod ends, pillow blocks, table drive, nuts & bolts, etc.. for problems, correct as needed.
- ☒ Check pindeck level, correct as needed
- ☒ Check machine height, and machine location in reference to the 7 – 10 pinspot line, correct as needed
- ☐ Make sure the table counterbalance springs are in place, repair attachment point if needed.

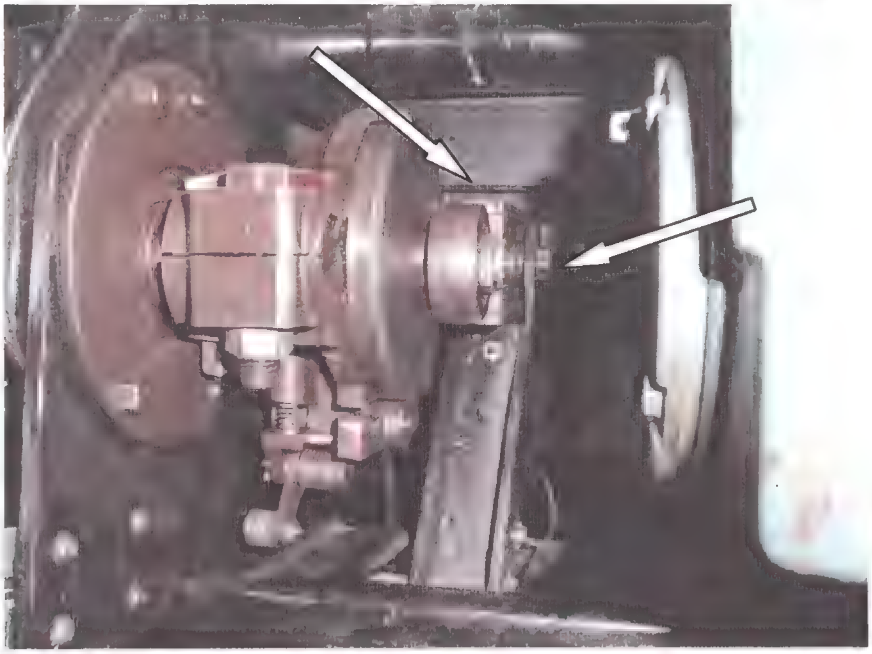
☐ Check table level side to side in relation to the pindeck adjust as required using the table support legs, newer legs use shims, older legs have adjusting nuts.



Check table level front to rear in relation to the pindeck adjust as required using the tie rods, adjust front of table approximately 1/16" lower than the rear.



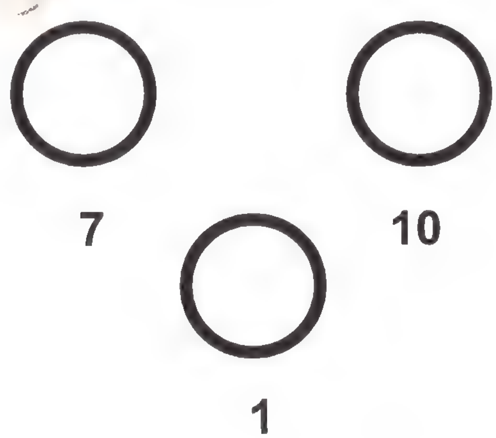
☐ Run table to BDC, the table should be 5/16” off the lane surface using the 6519 gauge, adjust as required using the clevis, better to be a little high than a little low.



☐ Have instructor check your adjustments

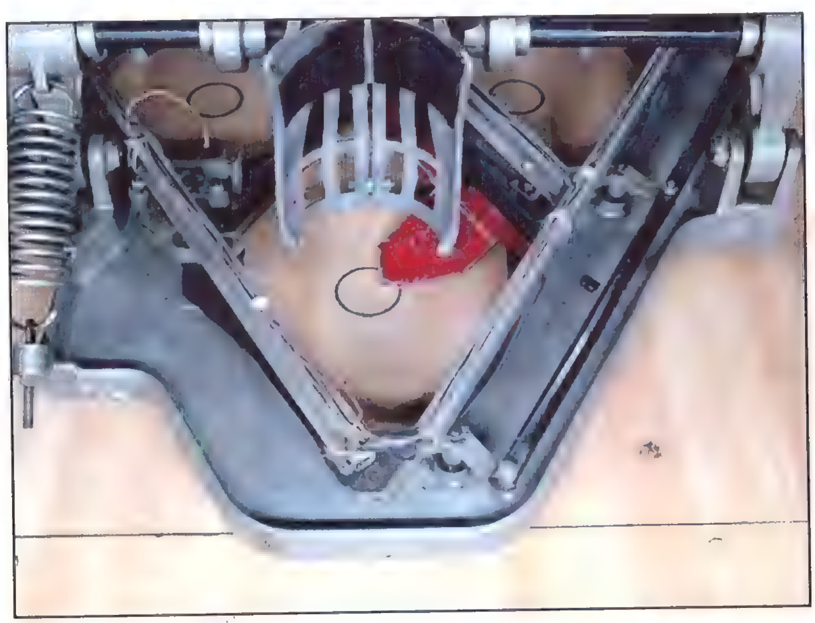
TABLE PHASE 2 ADJUSTMENTS CONT.

- [ ] Install the alignment flags, check and note the table alignment in the circles below.

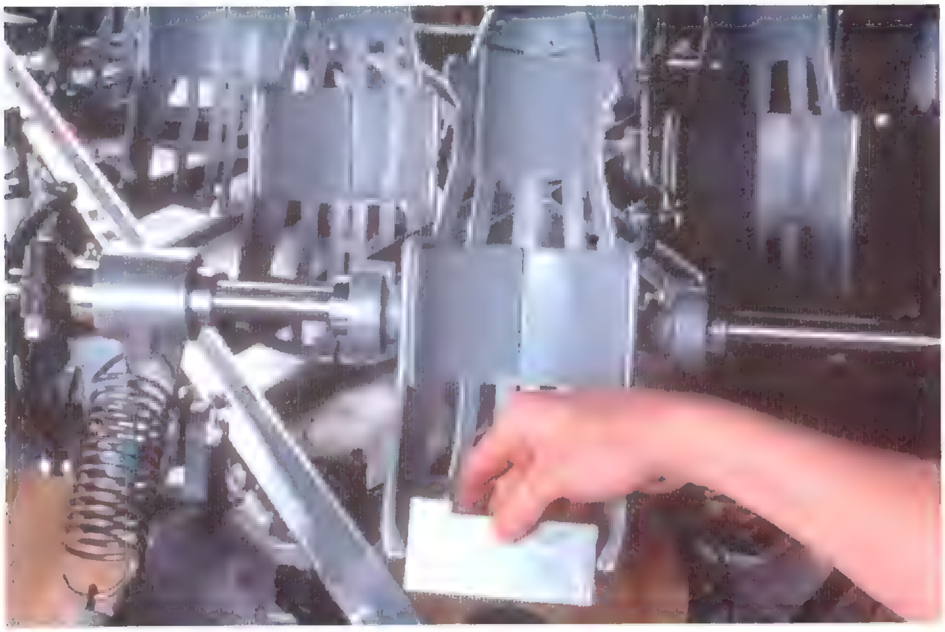


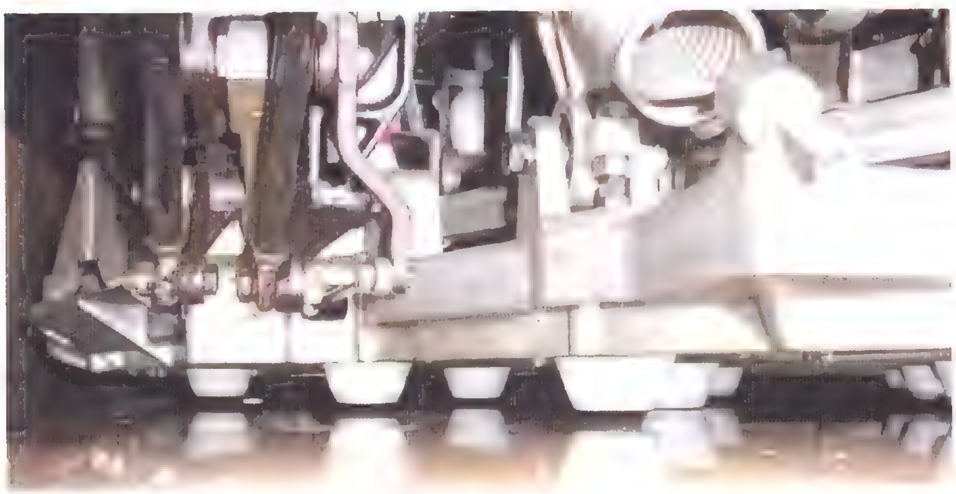
NOTE:
The instructor will tell you if the table needs to be repositioned.

NOTE:
If the table is repositioned,
the spot and respot rods will need to be readjusted.



- [ ] Check the spotting cup width, using the quick check method or adjust all spotting cups openings using the 6519 gauge, or use the quick check method by seeing how far the pins hang out of the cups.

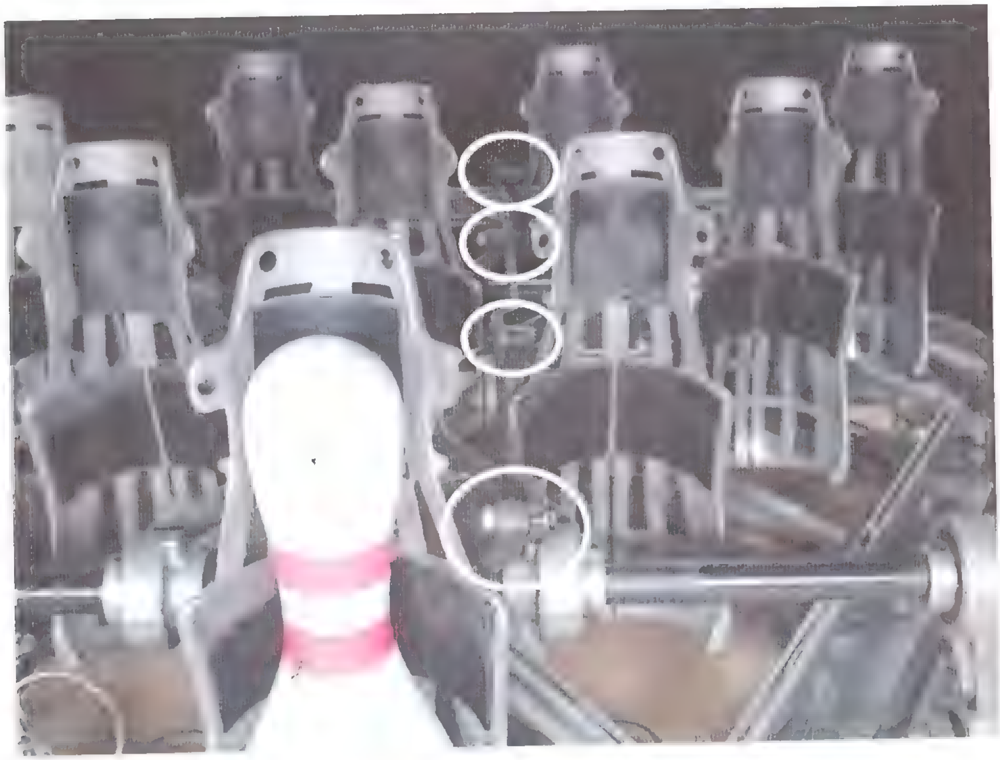




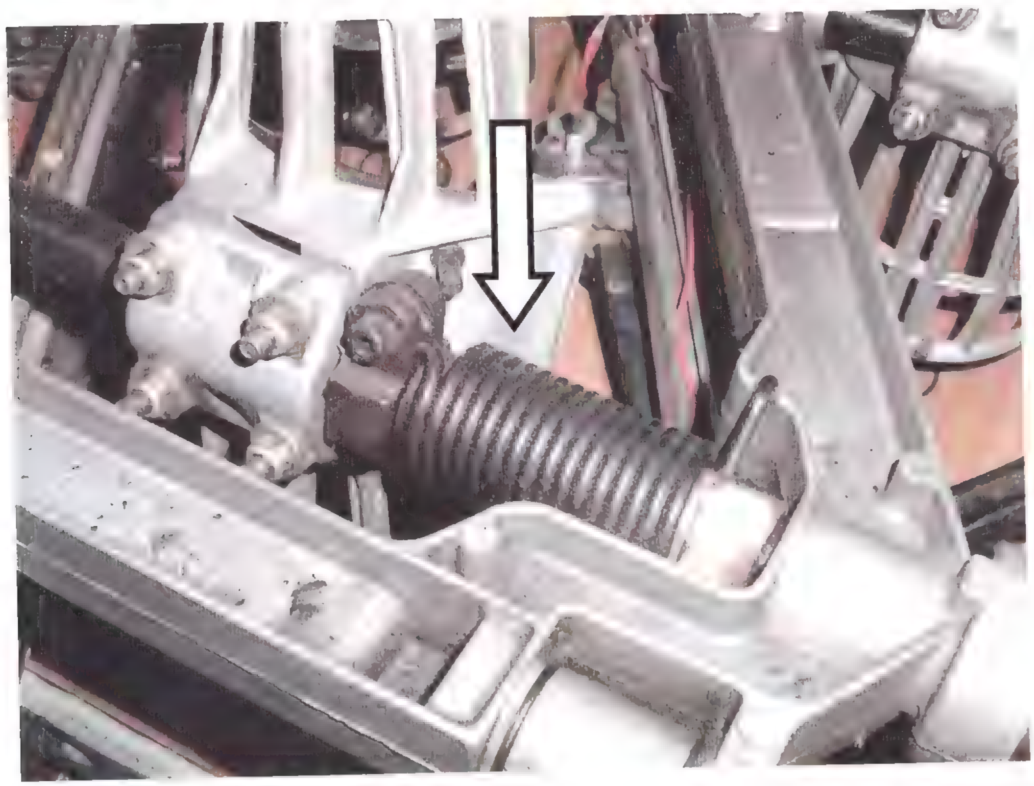
Run the machine to ensure it spots pins, they may not be on spot at this point, those adjustments will be covered in the next phase.

TABLE PHASE 3 ADJUSTMENTS

- [ ] Inspect spotting cups, liners, yoke shafts, table connecting link (lighting rod) bearings, rod ends, pillow blocks, nuts & bolts, etc.. for problems, correct as required.

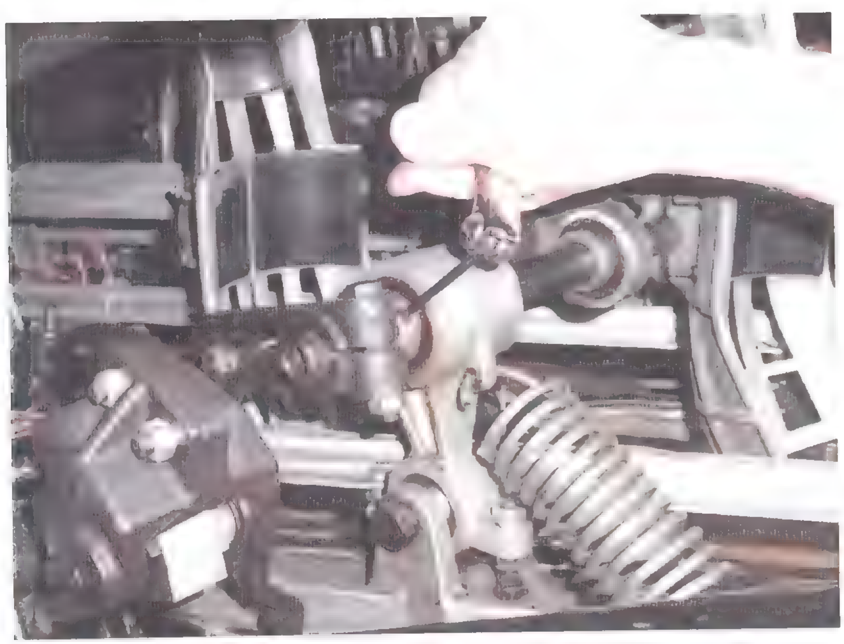


- ☐ Observe spotting cup motion, If cups slam back to the horizontal position the yoke springs are adjusted too tight, If cup movement to the vertical position is jerky the yoke springs are too loose
- ☐ All three yoke springs must be adjusted equally, older machines have 2 yoke springs.
- ☐ After adjusting, run machine with pins observe the cup movement, adjust as required

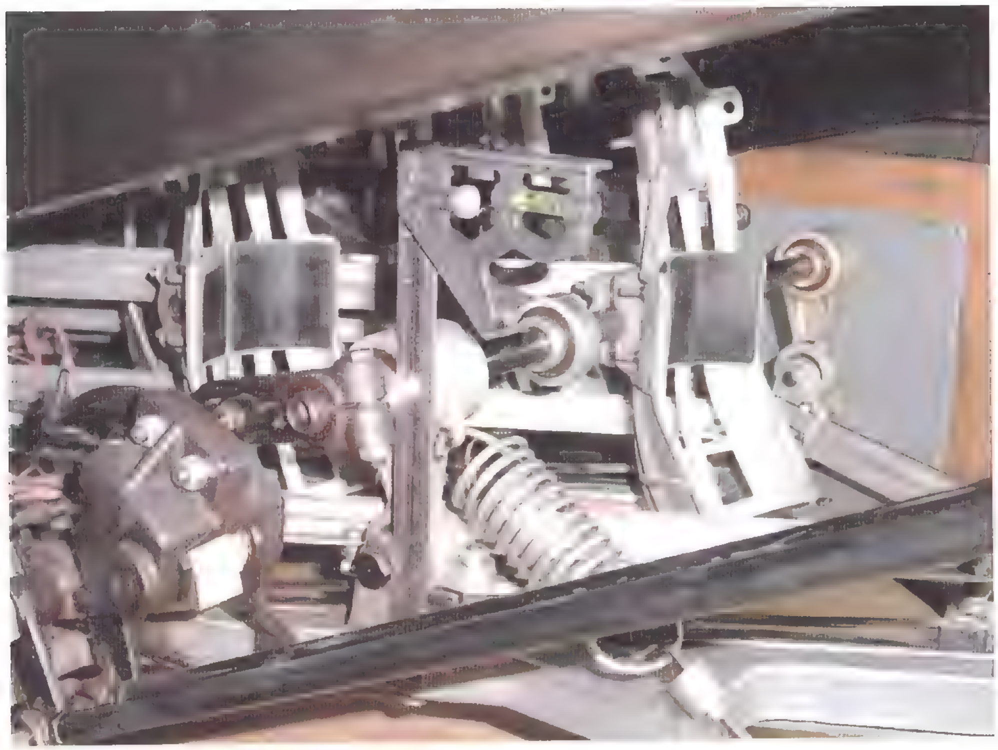


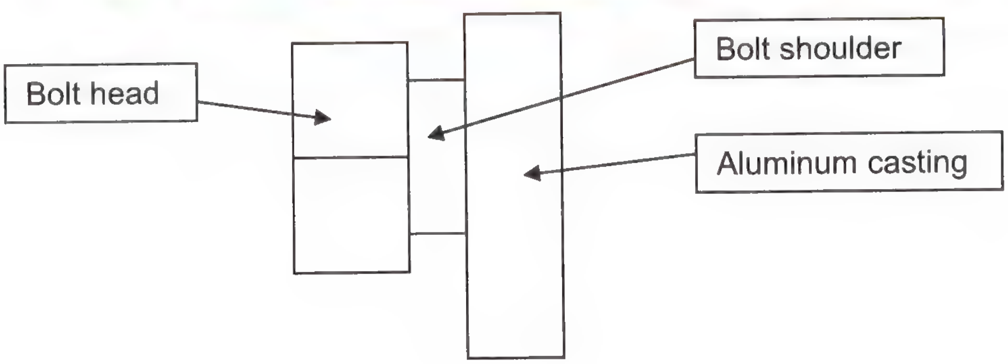
- [ ] Crank table into a spotting action **with pins** in all of the cups stop table at 6” off the lane surface, make sure the table shaft rotates the proper direction.

- [ ] Loosen the collar on the front yoke shaft next to the table leg on the 7 pin side of the yoke, move the collar to the left.



- ☐ Place combination square against the yoke shaft and shoulder of the table leg bolt, adjust the table leg bolt to obtain ½ a bubble rearward, move collar back into its original position and tighten.





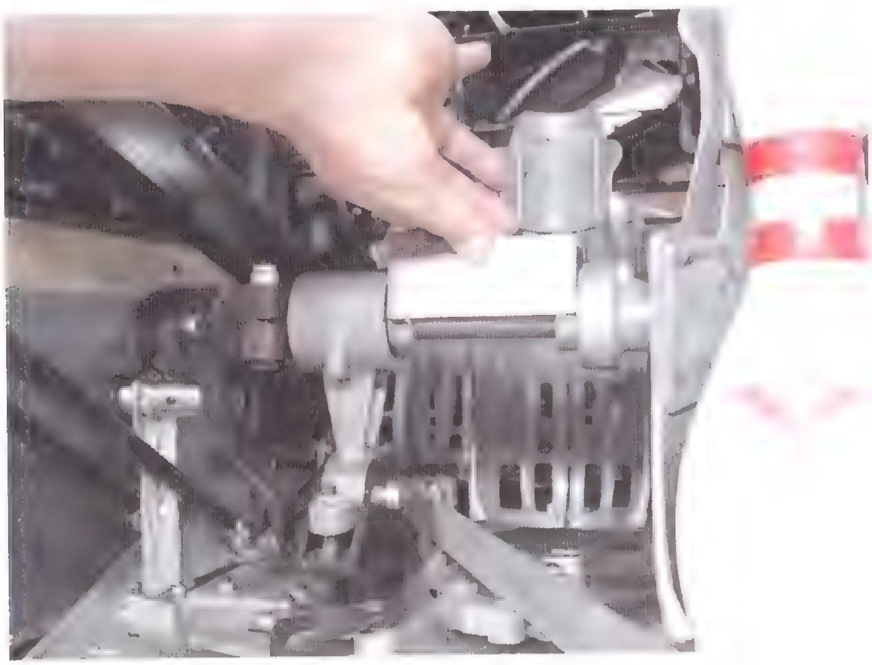
- ☐ Have instructor check your adjustments

❑ Crank table forward until the base of the # 1 pin is 5/16” off the lane surface

❑ Adjust the spot rod to obtain a slight clearance gap between the table leg bolt and pad, this gap should open up to approximately 1/16” when you push down on the front of the table.

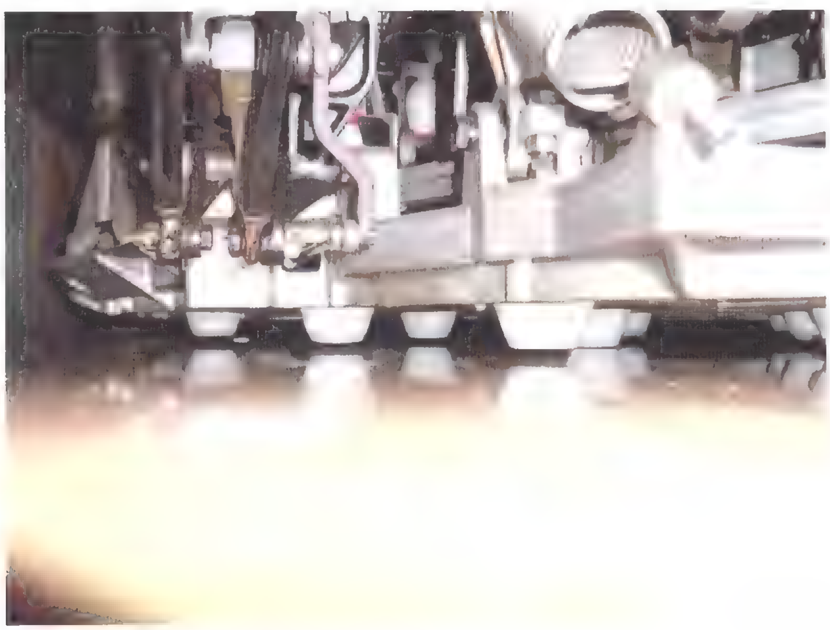
- [ ] Loosen the collars on both sides of the yoke.

- [ ] Adjust the yoke side to side so the 6519 gauge fits between the yoke leg and yoke assembly.

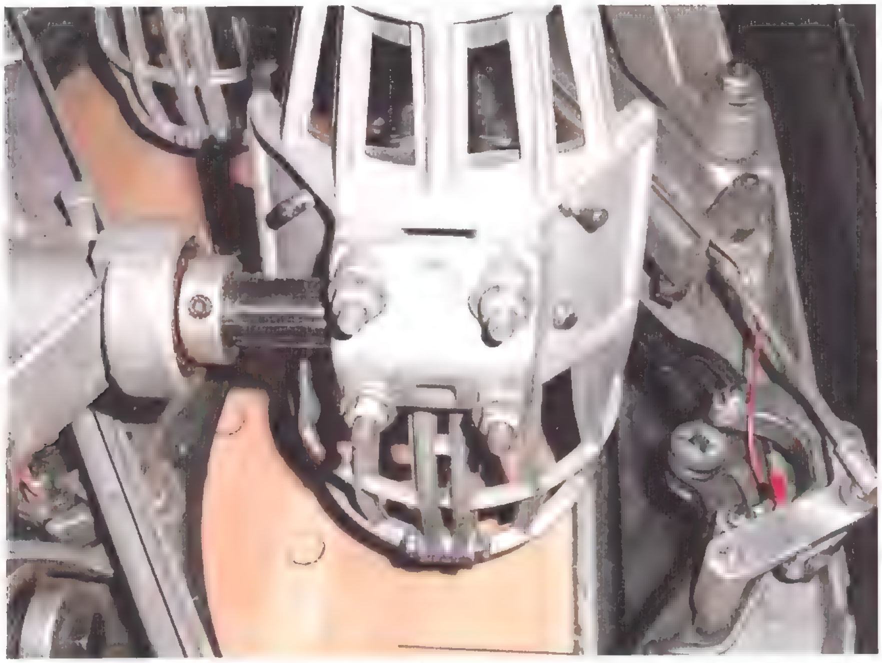


- [ ] Tighten the collars on both sides of the yoke.

- [ ] Crank table forward until the pins barely touch the lane



- [ ] Adjust the spotting cups to put pins on spot, loosen top tighten the bottom pins move rearward, loosen bottom tighten the top pins move forward.



- [ ] Run the machine with pins under power to check actual spotting, correct as required

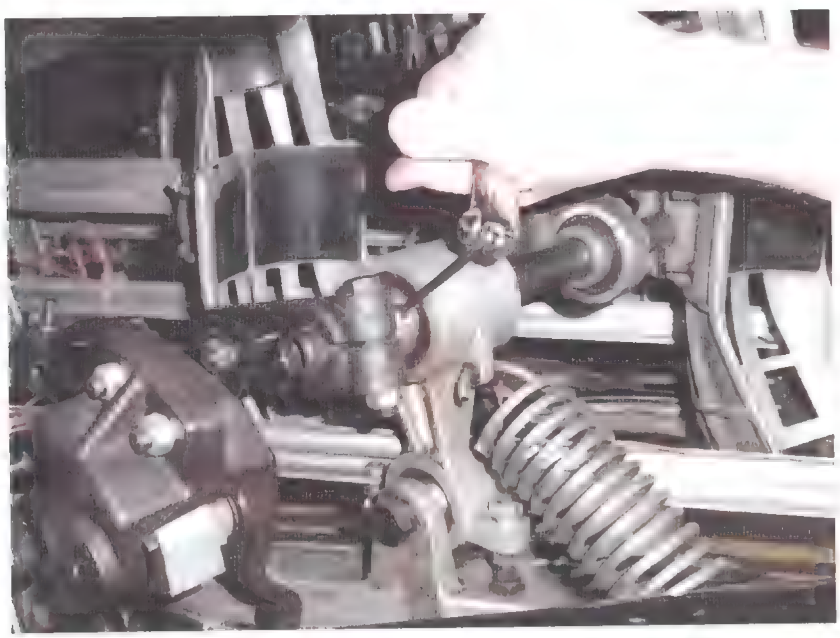
- [ ] Have instructor check your adjustments

- [ ] Return to classroom

TABLE TOE ALTERNATE ADJUSTMENT

- [ ] Crank the table into a spotting action with pins in the cups, stop table with the # 1 pin 5/16"off the lane surface, make sure the table shaft rotates the proper direction.

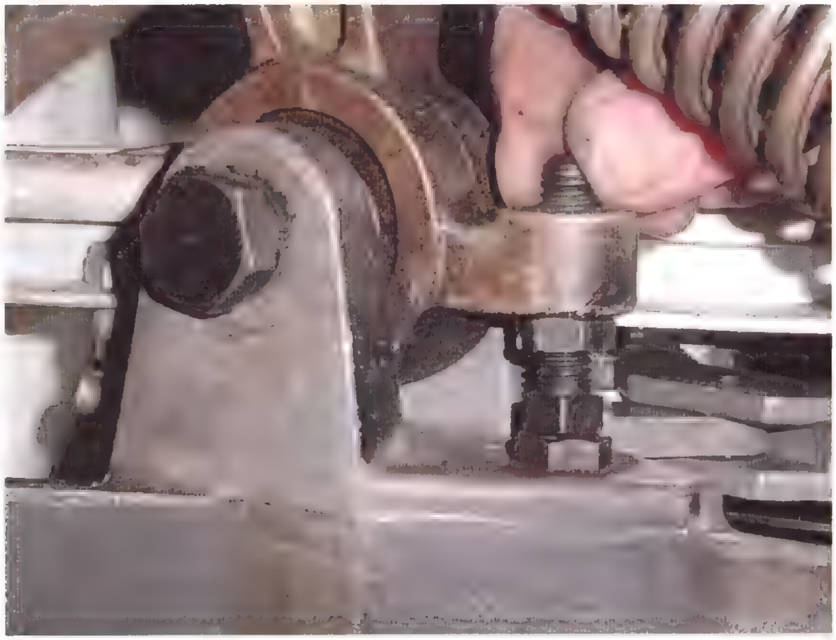
- [ ] Loosen the collar on the front yoke shaft next to the table leg on the 7 pin side of the yoke.



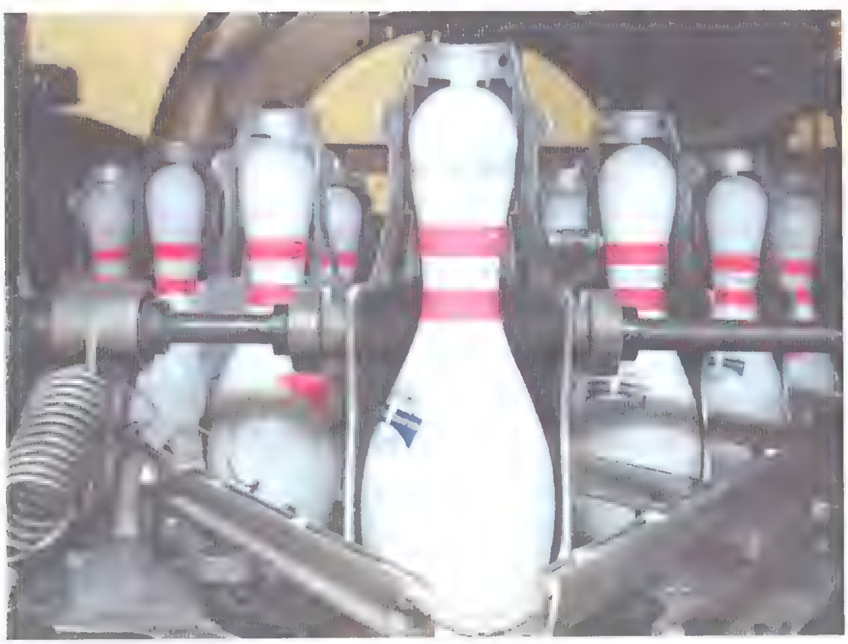
- ❑ Loosen and raise the table leg adjusting bolt to clear the stop pad.

- ❑ Loosen the jam nuts on the spot rod.
- ❑ Place combination square against the yoke shaft and shoulder of the table leg bolt.
- ❑ Turn the spot rod so the bubble on the combination square reads dead level, tighten spot rod jam nuts.

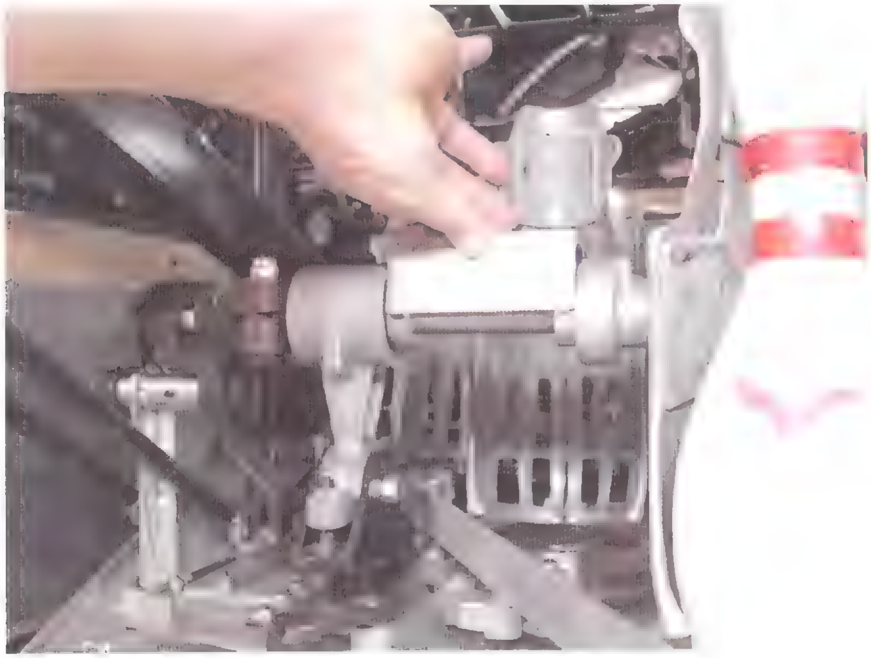
- [ ] Turn the table leg adjusting bolt down until it touches the stop pad and tighten the jam nut.



- [ ] Loosen the collars on both sides of the yoke.

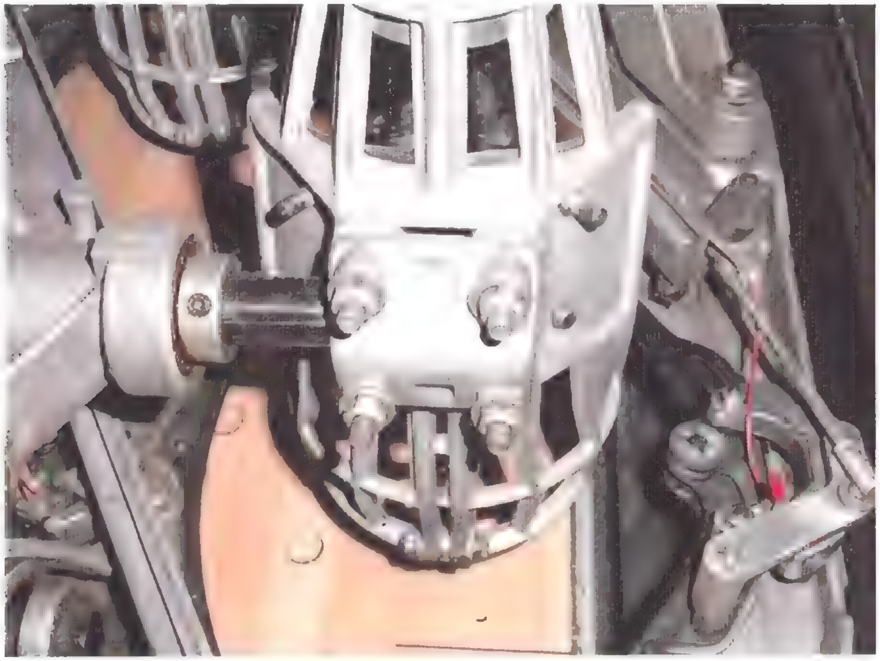


- [ ] Adjust the yoke side to side so the 6519 gauge fits between the yoke leg and yoke assembly.



- [ ] Tighten the collars on both sides of the yoke.

- [ ] Adjust the spotting cups to put pins on spot, loosen top tighten the bottom pins move rearward, loosen bottom tighten the top pins move forward.



- [ ] Run the machine with pins under power to check actual spotting, correct as required

- [ ] Have instructor check your adjustments

- [ ] Return to classroom

TABLE PHASE 4 ADJUSTMENTS–

Respot cells

Note: some of these adjustments are in a slightly different sequence from the book

- [ ] ***Disconnect all carburetor links except the #7 cell,*** actuate the linkage to check for binds, bent wireways, bent pins and distribution levers, this allows you to check the actuating mechanism independent of the respot cells. The movement should be smooth and free of any binds.

- [ ] Inspect all respot cell yokes, linkages, pins, bushings, bolts, levers, carburetor links, cell frames, cell frame bolts & finger bumpers, finger slides for problems, correct all problems prior to making any adjustments

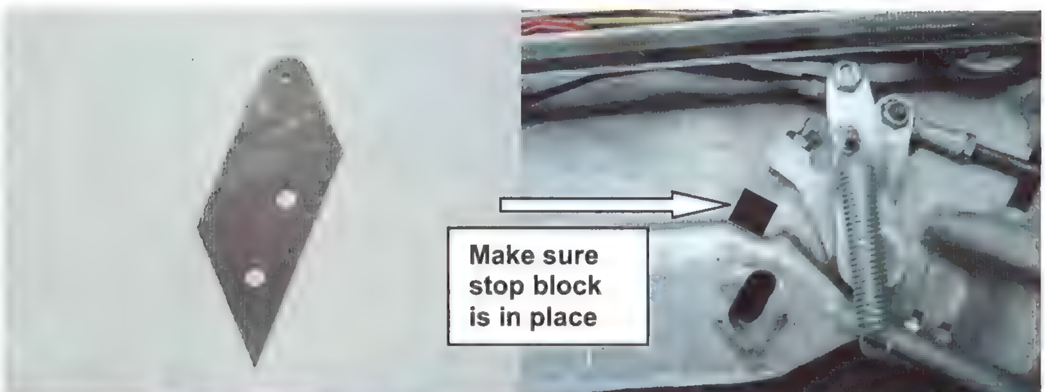
EACH STUDENT MUST REMOVE AT LEAST ONE RESPOT CELL, DISSASSEMBLE AND REBUILD THE CELL AND SHOW IT TO THE INSTRUCTOR.

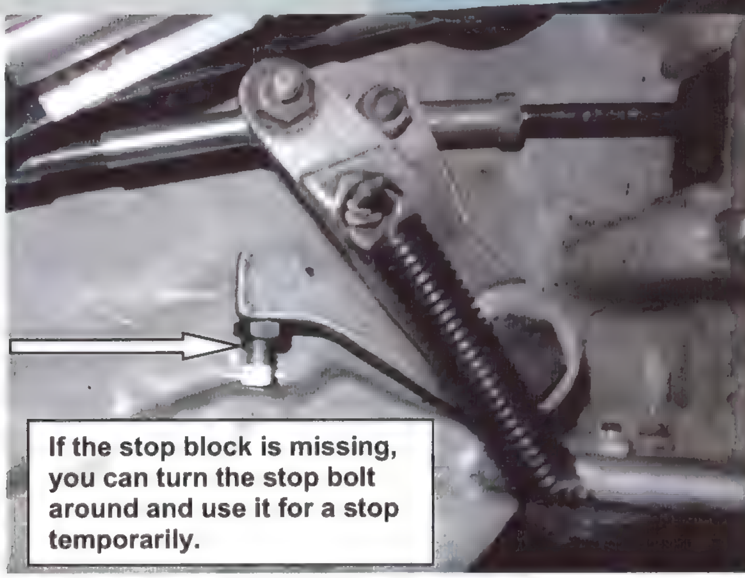
Page 5.25 Finger link to shifter link clearance

- [ ] With the table at 355 degrees, partially close the respot cell mechanism so the high point of the shifter cam link # 2724 is even with the pawl # 2590. Adjust respot rod to obtain 1/8" clearance, some machines will need to be adjusted closer, you must have **some** clearance to allow the finger to flip.

Page 5.22 Linkage bellcrank

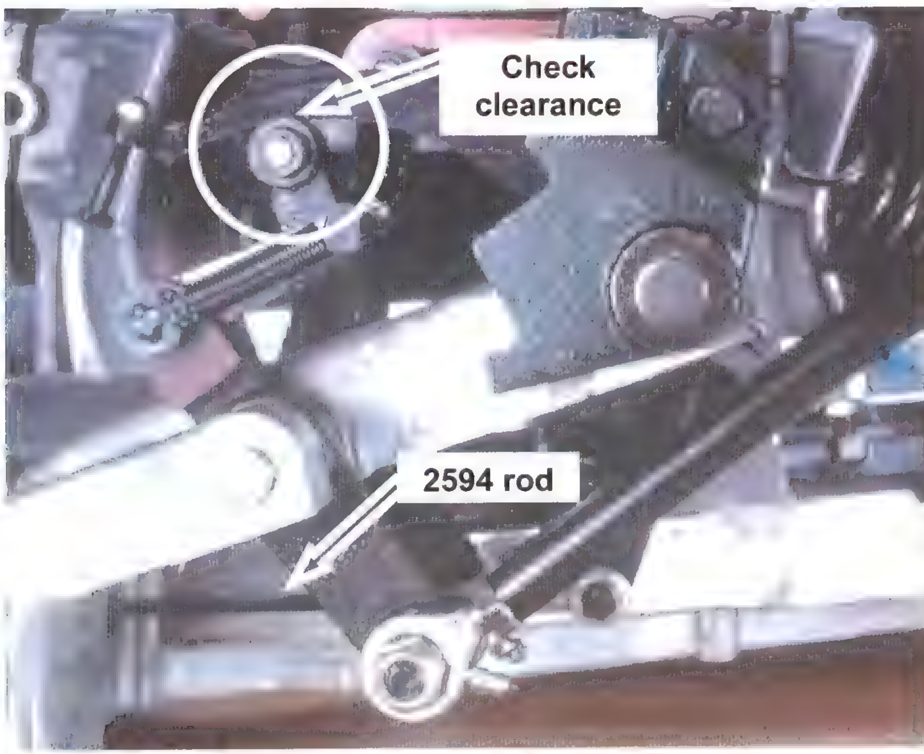
- [ ] Check respot cell bellcrank stop bolt, ensure there are approximately two threads protruding through the bellcrank arm.
- [ ] Inspect respot cell bellcrank over-center spring tab (page 25 item #23) this must be straight and the spring must be attached at both ends.
- [ ] Make sure the bellcrank stop block is in place. (page 25 item #11)





Page 5.24 2594 rod adjustment

- ❑ Crank table forward into a spotting action (hold up spot solenoid while cranking motor) until the table is 10" off of the lane
- ❑ Check the clearance between the shifter link cam and bearing, continue cranking the table down and checking clearance until the table is at BDC.
- ❑ Adjust rod # 2594 to obtain .010 to .020 clearance between bearing and shifter link cam (a slight up and down movement.)



- ❑ Crank table back to 355 degrees

Page 5.23 cell open adjustment

- [ ] Adjust # 7 cell to 1/4" to 1/2" off the rubber stop using the appropriate adjusting link, then adjust all remaining respot cell openings in the following order 7-4-2-1-8-5-3-9-6-10.

The shifter link must be held up during the adjustment of each cell, this can be done by hand or by using a spring.

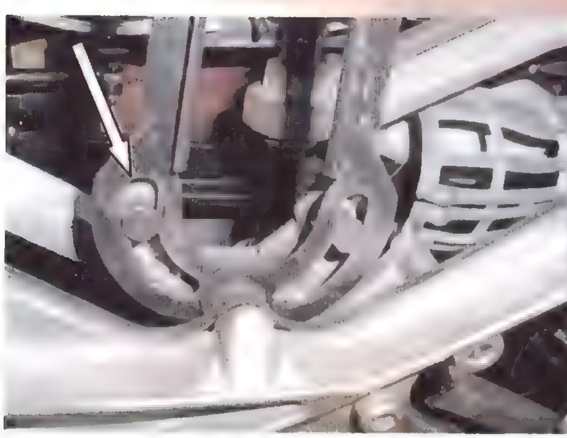
Page 5.21 cell closed adjustment

- [ ] Adjust respot cell fingers with 6519 gauge and 1/4" wrench.

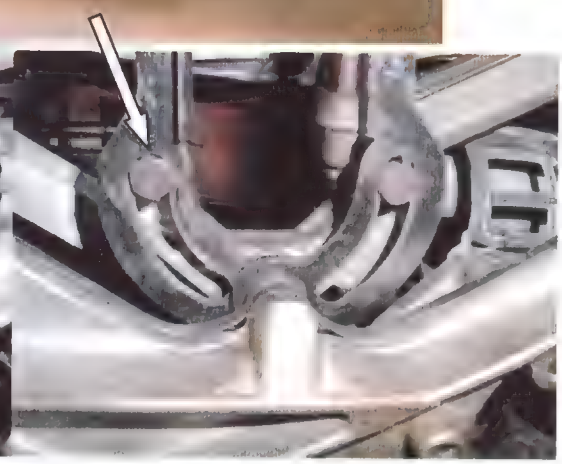
(Optional method) Pick up a full set of pins, stop the table at 180' (table is holding pins in the up position). The top of the upper ring on the neck of the pin, should be even with bottom of the respot cell fingers, if they are too low tighten the GS bolt, if they are too high loosen the GS bolt.

Page 5.24 shifter link stop bolt adjustment With the table at 355 degrees, loosen and back off the adjusting screw on the end of the shifter link.

- [ ] Close the respot cell mechanism fully, adjust the bolt down until it contacts the stop pad continue turning the bolt to obtain a ¼" gap between the cell finger stud and the slot in the cell fingers on the #7 cell. Tighten jam nut.



Gap too large cells may not pick up pins



Gap too small cells may lock on pins

TABLE SHAFT REMOVAL AND REPLACEMENT

(Refer to Page 15 in Parts section)

Removal

1. Turn off pin elevator switch, sweep pins into pit. Cycle Pinspotter to place second set of pins on deck. Sweep pins into pit then stop sweep at guard and remove power plug and pit light, lockout power plug.

2. Disconnect spot rod from lever, item 10. (Be careful of spring tension) disconnect re-spot rod from lever. Loosen bolts in shuttle cam, item 12; loosen nut on table cam stud, item 15, and tap to free cam assembly.

3. Crank table to 180* in spotting action-support table on block of wood.

4. Remove shuttle spring.

5. Remove bolt, item 39, and bearing, item 22 from clevis.

6. Loosen clamp bolt through table drive assembly, item 21, and slide assembly to right off shaft, item 7. Remove key, item 30 from shaft.

7. Remove spring, item 31 from spot and respot levers. (See page 5.39) tie levers up out of the way.

8. Move shuttle cam, item 12, to left then remove key from under cam.

9. Remove bolts, item 42 from cam switch assembly, item 13. Move table cam assembly; item 14 to left with shuttle cam.

10. Locate and loosen setscrew in bearing collar, item 20, at right end of shaft. (From bottom-up behind solenoid housing) locate hole in collar-use punch and hammer to rotate collar to free it from bearing race.

11. Move shaft, item 7, to right until left end is free of motor and shaft plate, item 32. Bring left end of shaft forward out of machine. The re-spot, spot, shuttle and table cams comes out with the shaft. (Note: if the machine has a bearing at the motor end of the table shaft, it may be necessary to remove the table motor and inboard bearing to gain clearance to free the shaft. This bearing is no longer used and may be replaced with shaft plate 070-006-765).

12. Measure distance from end of shaft to spot and re-spot cams, item 8, so cams can be accurately positioned on new shaft.

Replacement

1. Install key, item 30, in shaft, item 7, and position spot and re-spot cams, item 8 on shaft. Slide shuttle cam, item 12, table cams, item 14, and bearing lock collar on shaft. Coat splines end of shaft with grease.

2. Inspect bearing, item 20, and then slide right end of shaft through bearing until left end of shaft can be installed through shaft plate into motor.

3. Slide shaft into motor until spot and re-spot cams line up with cam followers on spot and re-spot levers. Reconnect spot and re-spot lever springs. (5.39)

4. Move bearing lock collar over bearing and tighten with punch and hammer. Tighten set-screw.

5. Install shuttle cam key and move shuttle cam into position. (Tighten bolts after table is at zero).

6. Install table drive assembly key and table drive assembly. Tighten clamp bolt. (Caution: do not push table drive assembly on shaft so far that it will strike bolts attaching bearing retainer, item 19).

7. Install bearing, item 22, and bolt, item 39, in over travel clevis, and install shuttle spring then crank table to zero.

8. Reconnect spot and re-spot levers.

9. Reinstall cam switch assembly bolts. Position table cam behind cam levers. Adjust levers and cams. (5.29)

10. Install pit light, crank sweep to zero. Connect power to machine and check operation.

Admim PM & Prog

ADMINISTRATION OF THE FACILITIES
PREVENTIVE MAINTENANCE PROGRAM

FRAMES PER STOP, DOWNTIME
PROBLEM TRACKING / REPORTING
FACILITY MAINTENANCE

Preventive Maintenance is a planned routine, in order for this program to be successful; there must be cooperation and communication between the Center Manager and the center Facility manager.

The proper "TOOLS" must be available for maintenance to be completed.

The type of equipment in our bowling centers is as diverse as the number of centers we own. Therefore, this program is a starting point and will need to be adjusted to your particular technical situation.

Name:____________________ Class:_________________

Rev 4/05

THE FIVE P'S OF MAINTENANCE

PERSONNEL:

You must have adequate personnel to do a quality job

PROPER TRAINING:

You must have properly trained personnel to do a quality job

PAYROLL:

You must devote the proper amount of time to complete the work

PARTS:

You must have the parts and supplies required to do a quality job

PREVENTIVE MAINTENANCE:

You must take care of small problems before they become BIG problems and disrupt business

IF YOUR TECHNICAL OPERATION IS WEAK IN ANY OF THESE AREAS

IT WILL FAIL !

TECHNICAL PERFORMANCE INDICATORS

FRAMES PER STOP

- The AMF **MINIMUM** standard for Frames Per Stop is currently **750**

- This indicator of machine performance is the number of frames bowled per trouble call. However, this system has its flaws:

1. Inaccurate stop reporting, all calls are not counted.
2. Inaccurate frame counts - frames bowled during practice are generally not counted.
3. Centers with very low lineage enhance the FPS # to the low side.
4. Centers with very high lineage enhance the FPS # to the high side

The formula for FPS is Total games multiplied by 11 divided by total stops.

6735 games X 11 = 74085 frames

74085 frames divided by 47 stops = 1576 FPS

Even a well maintained center will have a minimum amount of machine calls. A center running 6000 to 8000 games a week will average 5 to 8 call a day that the CFM has little control over. These are usually occasional Out of Range pins, the occasional "HARD" ball that wont go up the ball return, respots due to wobbling pins hit by the Table or Deck of the Pinspotting machine, and customer caused problems such as 17 balls in the machine. There is a certain threshold of calls even the best maintained centers will experience.

HOW YOUR LINEAGE AFFECTS YOUR FPS

Lets look at two centers running the same FPS with different lineage

Center A:
3,000 games X 11 = 33,000 frames divided by 40 stops = 825 FPS

Center B:
15,000 games X 11 = 165,000 frames divided by 200 stops = 825 FPS

Center A is actually running better than center B even though the FPS is the same.

ACCURUACY OF STOP REPORTING FPS

Concerning the issue of "false calls"

Example "They called for a ball return on lane 7, when I got to the machine there was no ball, so I don't count that call"

- Let's put this issue to rest, If a bowler has to wait long enough to call the counter for a ball return or a sweep.
- Often times, poor machine operations are masked by employees who run from machine to machine clearing jams and problems before the bowler ever realizes there was a problem.
- In many cases the jams or problems that occurred when never written down as "Calls". This will give a false sense of security about the machine operation.

IF A PROBLEM EXISTS
DENYING IT WILL NOT MAKE IT GO AWAY

THE REAL "REALITY CHECK"

- Inaccurate reporting will always be a problem for many reasons.
- If you ***really*** want to know how the machine operation is running
- Pull the mechanics out of the machine area on a busy night, ***IF THERE ARE PROBLEMS YOU WILL KNOW VERY QUICKLY!***

EQUIPMENT DOWNTIME

- This indicator of machine performance, by all rights, is more important than frames per stop.
- Our bowlers are less likely to become upset by an occasional ball return or out-of-range, as they would be by having their pair of lanes go down for 10 to 15 minutes and / or possibly have to move to another pair.
- Chronic downtime creates:

  - Increased stress on all employees, who must face the irate customer, and in turn make excuses / apologies for the machines.
  - Customers perception of the house as "run-down"
  - Loss of revenue and marketing effort.

- Our customers pay good money and they deserve the best technical operation.

EXPENSES

- Be aware of any abnormal expense patterns, excessive, or insufficient.

VISUAL OBSERVATIONS

- Usually, what you see is what you get.

- A machine area that looks disorderly and sloppy, usually indicates poor maintenance and bad machine operation with one crisis after another.

- A machine area that is neat, orderly, and on the PM program, can be managed much more efficiently, provide many years of service without excessive cost.

CUSTOMER COMMENTS

PERCEPTION IS REALITY

- If the bowlers think things are bad……..they usually are.

IMPROVING OUR TECHNICAL OPERATIONS

HIRE THE BEST PEOPLE YOU CAN AND TRAIN THEM

- Your staff can make or break your machine operation, if they are not helping you............***then what are they doing?***

- Take the time to properly train your staff, they will perform better and save you time and trouble in the long run.

- Untrained staff members are dangerous to your operation and themselves.

EFFECTIVE SCHEDULING

- When a center is running poorly, it is impractical for the Center Facility Manager to simply rely on "call sheets".

- In a center with a below standard operation, the facility manager should be at the center when the machines are running to see the problems firsthand.

- This schedule should include mixed shifts (I.E 1 pm to 9 pm) to allow time for repairs and observation of the machine operation.

- Once the operation **is at acceptable levels** the facility manager should be working a schedule that allows time for preventive maintenance work to be completed.

- The Facility manager should make unscheduled visits to the center to observe the operation, and to verify that the technical staff is completing work assignments. This type of floating schedule should not affect the other employees.

USE ALL OF THE RESOURCES AVAILABLE TO YOU

- It is **IMPOSSIBLE** for one individual to maintain a centers technical operation.

- The facility manager must **DELEGATE** work to the other mechanics on the staff.

- If problems become overwhelming, it is the responsibility of the facility manager to seek outside assistance.

PREVENTIVE MAINTENANCE PROGRAM

- A well-planned and executed preventative maintenance program will improve and help ensure a trouble free machine operation.
- A clean, lubricated, and adjusted machine will run better with fewer breakdowns.
- PM should be assigned every day and tracked on the company PM charts.

MACHINE INSPECTIONS

- Inspections should be performed on ¼ of the machines each quarter of the year, emphasis should be placed on correcting all problems with those machine within 3 months.
- The inspection is a detailed report of the physical condition of the machines, related equipment and lanes in the bowling center, it also points to the level of PM in the center.
- An accurate inspection brings potential problems to the attention of the center manager and facility manager.
- This helps the staff plan expenses for repairs, and payroll for training or major work.
- Clearing problems on a timely basis will help improve the technical operation.
- Often times some write-ups may seem insignificant. However, when you have several small problems, which translates to a machine that does not operate at acceptable levels with one crisis after another.

COMMUNICATION, DOCUMENTATION

COMMUNICATIONS

- It is essential for the center manager and facility manager to communicate on a daily basis.
- The "Technical Operations Report" is designed to bring the two parties together at least on a weekly basis.

TECHNICAL OPERATIONS REPORT

- This report is sent to the District manager on a weekly basis
- The report includes the following: Frames per stop, ball cleaner deposit, machine downtime, and comments from the center staff.
- Included with this report is a copy of the machine stop summary, this provides backup for the frames per stop number.

TECHNICAL OPERATIONS REPORT IS COMPILED FROM:

CONTROL COUNTER STOP SHEETS

- This is a daily report that documents what type of machine malfunction calls occurred for that day.

MACHINE AREA STOP SHEETS

- This is a daily report that documents what types of calls were received, and the reason the call occurred.
- Machine area stop sheets also include a table of maintenance assignments; this helps the facility manager schedule PM and document work that has been completed.

MACHINE STOP SUMMARY

- This is a “tally” board type of report which calls from the stop sheets are transferred to the summary on a daily basis.
- This summary will help the mechanic identify those machines that have chronic and occasional repeat trouble calls.
- This summary is most effective if it is maintained on a daily basis.

PROPER RECORD KEEPING

- Records for a given week should be kept together in a package, this package should be assembled from bottom to top, as follows: Machine area stop sheets with control counter stop sheets, Technical Operations Report, and Machine Stop Summary.
- It is a good practice to keep the most current three weeks of stop summary reports in an area that is highly visible. This way any reoccurring problems can be spotted quickly.

DAILY ADMINISTRATIVE ITEMS FOR FACILITY MANAGERS

This routine is the first step of a good preventive maintenance program. Any successful program relies heavily upon communication, record keeping and training.

1. **MACHINE RUNOFF**, turn on pinsetters, scorers, and foul lights.
   Cycle each machine and check: Pinspotting, respotting, sweeps / rakes, 1st. & 2nd. Ball lights, general machine operation, foul lights, scoring monitors, listen for any unusual noises in the ball returns, check approaches for marks or trip hazards.
   Note and correct any problems needing attention.

2. Check and compare the control counter call sheet and machine area call sheets, transfer calls to the weekly stop summary.

3. Obtain the games bowled for the previous day and enter the games on the weekly stop summary.

4 Check the maintenance assignments left for the previous night, these include but are not limited to; daily, weekly, monthly PM, carpet covers, ball wipes, caps and gutters.

   If any items are incomplete or of substandard quality:
   - Make a note on the call sheet.
   - Discuss the problem with the employee face to face.
   - Show the employee exactly what you expect.
   - Take the time to train the employee properly.

5. Commence work based on needs of the center and the preventive maintenance program.

6. Near the end of your shift allow sufficient time to clean up any mess and to put any tools away - ***Do not leave a mess for the person following you.***

   A Facility Manager must lead by example, if a FM leaves the machine area disorderly, how can he expect his employees not to leave it the same way.

7. Assign maintenance duties for that night and or next few shifts, discuss the work with the employee coming on duty, also discuss any problems that you have noted from prior shifts.

8. Periodically make surprise visits to check on your "B" and "C" mechanics, call your center on occasion and talk to the manager on duty. Often, you will discover issues that you will never see on a call sheet.

<u>WEEKLY ADMINISTRATIVE ITEMS FOR FACILITY MANAGERS</u>

1. Complete your weekly TECHNICAL OPERATIONS REPORT, this report should be reviewed with your CENTER MANAGER. The report and a copy of your stop summary should be sent to your DISTRICT MANAGER.

2. Complete a FACILITIES INSPECTION, this should be done in conjunction with the center manager.

3. Formulate a FACILITIES ACTION PLAN to correct problems found.

Exercise # 1

With your teammate, construct a sample week of stop reports and work assignments.
Collate your stops on the stop summary, and complete the Technical operations report.

Exercise # 2

Perform a machine runoff, note all problems observed on your assigned lanes.

Exercise # 3

Perform a building maintenance inspection, use the Facilities PM chart as a guideline, note all problems observed.

Exercise # 4

Formulate a realistic action plan to correct all problems found within one week.

MACHINE RUNOFF- AMF 82-70/90

DAY/ DATE:____

Lane	Problem found	Assign to

MACHINE RUNOFF- AMF 82-70/90

DAY/ DATE:____

Lane	Problem found	Assign to

MACHINE RUNOFF- AMF 82-70/90

DAY/ DATE:____

Lane	Problem found	Assign to

MACHINE RUNOFF- AMF 82-70/90

DAY/ DATE:______________________________

Lane	Problem found	Assign to

FACILITIES INSPECTION

DAY/ DATE:______________________________________

Priority	Problem found	Assign to

FACILITIES INSPECTION

DAY/ DATE:________________________________

Priority	Problem found	Assign to

FACILITIES INSPECTION

DAY/ DATE:____

Priority	Problem found	Assign to

FACILITIES INSPECTION

DAY/ DATE:____

Priority	Problem found	Assign to

FACILITY ACTION PLAN

Center:____

Facility Manager:____________________________________

Week Of:____________________ Page _____ of __________

PROBLEM	CORRECTIVE ACTION REQUIRED	ASSIGNED TO	COMPLETE BY

FACILITY ACTION PLAN

Center:____

Facility Manager:__________________________________

Week Of:__________________ Page _____ of _____

PROBLEM	CORRECTIVE ACTION REQUIRED	ASSIGNED TO	COMPLETE BY

FACILITY ACTION PLAN

Center:____

Facility Manager:__________________________________

Week Of:________________ Page ____ of __________

PROBLEM	CORRECTIVE ACTION REQUIRED	ASSIGNED TO	COMPLETE BY

FACILITY ACTION PLAN

Center: ______________________________

Facility Manager: ______________________________

Week Of: ______________________ Page ______ of ______

PROBLEM	CORRECTIVE ACTION REQUIRED	ASSIGNED TO	COMPLETE BY

AMF BOWLING CEN
FRAMES PER STOP TR

CENTER: ____________________

FPS / Week of year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
2000 +																													
2000																													
1900																													
1800																													
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1200																													
1100																													
900																													
800																													
750 Minimum																													
700																													
600																													
500																													
400																													
300																													
200																													
100																													

AMF Minimum Standard FPS is 750 Formula for FPS= Total Games X 11= Total Frames, Total Fr

PM

AMF 82-70 / 90
QUARTERLY LUBRICATION

CENTER: **FROM:** **TO:**

Lane #	1	2	3	4	5	6	7	8
Table and sweep cam lever rollers, and cam lever pivots								
Table torque tube pillow blocks, connecting tie rod ends, bushings, table spring roller bearings								
Respot cells and distribution link pivot points, yoke leg bushings and sperical bearings								
Spot, respot arm grease fittings								
Sweep torque tube pillow blocks, telescoping links, connecting rod ends								
Respot shifter mechanism, finger link								
Distributor-assembly, reference service manual								
Ball elevator, rudder drive, start switch pivots, pin ejector, track rail assembly								
All belt tensioners								

AMF 82-70 / 90
SEMI ANNUAL LUBRICATION

CENTER: **FROM:** **TO:**

Lane #	1	2	3	4	5	6	7	8
Table support leg sperical bearings								
Table drive cam ball stud								
Apply a light film of grease to the inside of the clevis								
Bin switch lever pivots								
Off spot overtravel lever								
Shuttle support rod ends								
Front roller links, bearings and front roller supports								

AMF

AMF 82-70 / 90
ANNUAL LUBRICATION

CENTER: **FROM:** **TO:**

Lane #	1	2	3	4	5	6	7	8
Sweep motor / gearbox service, grease motor bearings, drain and refill gearbox oil, pull gearbox clean splines apply anti seize compound to the shaft splines, crank gearbox 10 times prior to installing								
Table motor / gearbox service, grease motor bearings, drain and refill gearbox oil, pull gearbox clean splines apply anti seize compound to the shaft splines, crank gearbox 10 times prior to installing								
Backend motor service, grease motor bearings, drain and refill gearbox oil								
Table drive assembly								
Shuttle operating rod								
Ring tube oiler, remove spring and wick, clean out reservoir, install new wick and AMF way oil								

FACILITIES
MONTHLY PREVENTIVE MAINTENANCE

CENTER: ______________________ **MONTH:** __________ **YEAR:** __________

Maintenance item	Date	By	Maintenance item	Date	By	Maintenance item	Date	By
HVAC – Replace filters in all units, write the date on the filter when installed			EXTERIOR LIGHTING - Parking Lot, Building , signs, all working, time clocks adjusted for current timing			ALL DOORS – inspect / correct panic hardware, door closers, hinges, door pulls		
HVAC - check fan motor belts for wear, grease motor bearings			PARKING LOT - Inspect for potholes, striping and fire zone curb paint, arrange for repairs			INTERIOR LIGHTING – all interior and EMERGENCY EXIT lights are operational		
HVAC – check / clear condensation drains, clean return air grills			KITCHEN VENT HOOD SYSTEMS - check vent hood fire systems, arrange for service, exhaust vents cleaned quarterly			FURNITURE - inspect / correct, bent chair legs, loose tables, etc.		
ROOF MAINTENANCE – clean / clear drains, gutters, down spouts are securely fastened, notify RFM of any roof leaks			REFRIGERATION EQUIPMENT – clean the condenser coils, coolers, coke machine, freezers, etc…			CARPETING - Inspect correct carpet for trip hazards, loose moldings, step off into bowlers area, etc.		
DUMPSTER AREA - clean, check / correct dumpster fence, or arrange for repairs			SPRINKLER SYSTEM - certification must be current, clean dust off of the sprinkler heads			RESTROOMS – inspect / correct stall doors, toilet paper, soap, and hand towel dispensers		
EXTERIOR BUILDING WALLS - check for graffiti, arrange for repairs			FIRE EXTINGUISHERS – inspect all service tag must be current			RESTROOMS - Inspect all toilet flush valves, toilet seat fastenings, arrange for repairs		
CANOPY OR AWNING – inspect / correct problems, or arrange for repairs			WARNING DECALS – ensure that all applicable decals are in place and readable, replace as needed			ADA – check all ADA compliance issues, building access, signs, etc.		

AMF PINSPOTTER LUBRICATION

Lubrication is one of the most important items in the proper operation and maintenance of the Automatic Pinspotter.

Care must be taken to insure correct lubrication and to avoid excessive use of lubricants to prevent the possibility of transmitting it to the bowler.

The following pages indicate the points of lubrication, the correct lubrication and the frequency of lubrication.

Before lubricating exposed surfaces, it is recommended that the old lubricant first be removed.

LUBRICANT SYMBOLS	RECOMMENDED LUBRICANT
□	Items marked with this designation pertain to oiling. SAE #30 oil is recommended for overall machine lubrication.
○	Items marked with this designation Pertain to greasing. Lithium based Grease is recommended for all Bearings and exposed surfaces.
✡	Items marked with this symbol pertain to the lubrication of the gear head motors used on the sweep, table, and backend.
◇	The item marked with this designation applies to the recommended lubricant for the pin elevator wheel ring tube. This is a special oil know as Way Oil SAE# 80.

General Lubrication tips

Preventive Maintenance is a key to keeping your machines running at maximum efficiency. Following are some maintenance tips to help you improve machine operation and reduce costs for your center.

Lubrication

Read your lubrication charts. Many mechanics use the wrong lubricant believing it will perform better.

1. **LUBRICATING OIL** should be lightweight oil, no more than 30 weight. Gear oil is too thick for general lubrication and tends to gum up parts. Lightweight oil penetrates and lubricates much faster.

2. **GEAR OIL** is used in the gearbox only. Gearbox oil should be changed on a yearly basis. **AMF** 82-70 and 90 machines use 90-140W.

3. **BRAKE FLUID** is used to lubricate rubber parts. Brake fluid does not deteriorate rubber like oil or grease. Remember that all the parts contacting the rubber part need brake fluid, also. If any oil or grease touches a rubber part, it will cause that part to wear out prematurely.

4. **GREASE** is used in sealed bearings, spherical bearings, rod ends and other enclosed areas that cannot be easily reached.

5. **ANTI-SEIZE** is a special lubricant used to protect metal to metal contact points like the splines on the Table and Sweep shafts where they fit into the gearbox, or places where two or more different metals come into contact such as a steel bolt that threads into an aluminum casting. It will help eliminate moisture, dirt and vibration which can cause unnecessary thread wear and damage. Anti-seize allows for easier removal of a bolt. Anti-seize can be purchased at most auto parts stores.

Note:

Always clean the area you are lubricating. Dirt mixed with oil creates something similar to liquid sandpaper. Dirt is your enemy; keep your machines clean as well as lubricated.

Oilite type sleeve and flanged bearings are made of bronze or iron powder that is formed in a mold under extreme pressure. This material is porous and holds the oil in its pores, as heat builds up in the bearing the oil seeps from the pores, this keeps the bearing constantly lubricated. Some of these bearings are internally grooved and impregnated with a graphite compound for additional lubrication. If grease is used on these style bearings the grease will clog the pores. Once this happens, the bearing will begin to wear out as will the part it is meant to lubricate.

A special oil known commercially as Way Oil, SAE #80, is recommended for lubricating the ring tube supporting the pin elevator wheel. The Way Oil is wick fed to the bearing surface of the ring tube and will adhere to the surface without dripping. If this oil is not obtainable locally it may be ordered from AMF under-part number 715-021-006.

AMF 82-70 / 90
QUARTERLY PREVENTIVE MAINTENANCE

CENTER: **FROM:** **TO:**

Lane #	1	2	3	4	5	6	7	8
Clean the machine framework, drip pans								
Tighten the ring tube, and pin holder bracket bolts								
Tighten machine front-end jackscrews, ball track bolts								
Tighten pit cushion and hanger box bolts								
Remove the distributor clutch assy. Clean the pinion and sleeve, friction disks metal and plastic, use a fine emory cloth to smooth all surfaces, reassemble and lubricate pinion sleeve.								
Check: bin bumpers, shock mounts, 1 pin track, butt plates, stringers, pin holders brackets, shuttle straps, shuttle operator rod, Repair as needed Tighten: Bin and shuttle bolts								

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AMF 82-70 / 90
ANNUAL PREVENTIVE MAINTENANCE

CENTER: **FROM:** **TO:**

Lane #	1	2	3	4	5	6	7	8
Check the following for worn or broken parts, repair or replace as needed:								
Table and sweep arms, shaft bushings, keyways and pillow blocks								
Complete Annual lube chart items								
Check / correct gearbox oil leaks								
Rebuild table drive assembly								
Rebuild carpet roller and pit assembly								
Rebuild distributor assembly								
Rebuild ball lift assembly, light ball sensor								
Clean underground return tracks, tighten dropsweep track								

AMF 82-70 / 90
MONTHLY LUBRICATION

CENTER: ______________________ **FROM:** __________ **TO:** __________

Lane #	1	2	3	4	5	6	7	8
Grease fittings for respot and spot cam follower bearings								
Respot / spot and shuttle cam surfaces								
Oilite bearings and roller arm in the table drive latch mechanism								
Oilite bearings in respot and spot levers, tension spring plates								
Oilite bearings in spot solenoid linkage								
Distributor pinion and stop blade								
Check ring tube oiler, refill as needed with AMF way oil								
Sweep pantograph link bushings								

AMF 82-70 / 90
DAILY PREVENTIVE MAINTENANCE

CENTER: ____________________ **MONTH:** ____________________

Day of the month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Check the call sheets for the previous day, transfer calls to stop summary																															
Cycle / check machines, pinspotting, sweeps, foul lights, related equipment																															
Investigate / correct machines that have developed a malfunction pattern.																															
Clean Ball lift belts, Pin elevator wheel, Pin guide, Orienter pan																															
Keep work area, workbench, service aisle clean and orderly																															
Empty trash cans																															
Assign and record completed PM on the PM charts																															

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AMF 82-70 / 90
WEEKLY PREVENTIVE MAINTENANCE

CENTER: ______________________ **MONTH:** ______________

Week of the month	1	2	3	4	5
Service Machine #'s					
Clean shuttle and bin					
Check ball door exit, door rings or segments & fillers, paddle, LBS operation, repair as needed					
Clean distributor belt, pit carpet belt, clean under the machine					
Clean, pin curtain, pit cushion and tube weldment					
Tighten plows, check for cracks, replace as needed					
Change ball wipes, do not turn them inside out					
Inspect distributor, observe for proper operation, correct as needed					

AMF 82-70 / 90
MONTHLY PREVENTIVE MAINTENANCE

CENTER: ______________________ **MONTH:** ______________________

Lane #	1	2	3	4	5	6	7	8
Check, clean, correct, adjust, spotting cups, respot cells, table assembly in general								
Check, clean, correct, adjust, sweep assembly								
Check, correct, adjust starter pad, kicker rollers PBL assemblies, balltracks, downsweeps								
Check, correct, adjust carpet belt tracking, front and rear rollers								
Check, correct, adjust bounceboard, dampers, supports, ground strap								
Check, correct, adjust cushion assembly, shock, start switch								
Check all machine belts, replace as needed								
Clean Distributor assembly in general								

Cycles

Sweep sequence

Ball sensor or SS signals chassis to start cycle sequence

Sweep runs to first guard 66 degrees and stops when cam switch SB goes to the high dwell of the cam

SB also signals the chassis for a 3.5 sec delay for table run

Table runs to feel for pins, as cells close on GS switches tell the chassis if pins are present, when TA2 hits the high dwell of the cam it signals sweep run through

Sweep runs through, at 186 degrees of sweep shaft rotation the SB cam switch goes to the low dwell of the cam and signals the table to run and respot pins, the sweep continues to run and stop at 2nd guard when cam switch SA hits the high dwell of the cam

The table continues to run and re spot pins.

When cam switch TA1hits the high dwell at 260 it signals the sweep to run home.

Sweep runs to the home position and stops home position when cam switch SA hits the low dwell of the cam

The table continues to run and stops the home position of 355 degrees when cam switch TA1 hits the low dwell of the cam

End of cycle

FIRST BALL STANDING PINS AND STRIKE SS or MP CHASSIS

Ball sensor or SS signals chassis to start cycle sequence

Sweep runs to first guard 66 degrees and stops when cam switch SB goes to the high dwell of the cam

Scorer start signal is sent to the CWC from scorer start switch or ball detect, pinfall information is sent from CWC to machine chassis

SB also signals the chassis for a 3.5 sec delay for table run

Table runs to feel for pins, as cells close on GS switches tell the chassis if pins are present, when TA2 hits the high dwell of the cam it signals sweep run through

Sweep runs through and stops at 2nd guard when cam switch SA hits the high dwell of the cam

Pins? YES NO

The table continues to run and re spot pins.

When cam switch TA1hits the high dwell it signals the sweep to run home.

Sweep runs to the home position and stops home position when cam switch SA hits the low dwell of the cam

The table continues to run and stops the home position of 355 degrees when cam switch TA1 hits the low dwell of the cam

Table runs back to TDC, if the bin switch is closed the spot solenoid is activated and the table runs and spot pins.

When cam switch TA1hits the high dwell it signals the sweep to run home. Sweep runs to the home position and stops home position when cam switch SA hits the low dwell of the cam

The table continues to run and stops the home position of 355 degrees when cam switch TA1 hits the low dwell of the cam

End of cycle

FIRST BALL STANDING PINS AND STRIKE MP CHASSIS OR LATER WITH AMF SCORING

Ball sensor or SS signals chassis to start cycle sequence

Sweep runs to first guard 66 degrees and stops when cam switch SB goes to the high dwell of the cam

Scorer start signal is sent to the CWC from scorer start switch or ball detect, pinfall information is sent from CWC to machine chassis

Gutter or 7 or 10

Sweep runs in reverse under the control of the chassis

End of cycle

Strike

Other pinfall

Sweep runs through and stops at 2nd guard when cam switch SA hits the high dwell of the cam

If the bin switch is closed the spot solenoid is activated and the table runs and spot pins.

When cam switch TA1hits the high dwell it signals the sweep to run home. Sweep runs to the home position and stops home position when cam switch SA hits the low dwell of the cam

The table continues to run and stops the home position of 355 degrees when cam switch TA1 hits the low dwell of the cam

SB also signals the chassis for a 3.5 sec delay for table run

The table runs to pick up and re spot pins.

When cam switch TA1hits the high dwell it signals the sweep to run home.

Sweep runs to the home position and stops home position when cam switch SA hits the low dwell of the cam

The table continues to run and stops the home position of 355 degrees when cam switch TA1 hits the low dwell of the cam

End of cycle

SECOND BALL

Ball sensor or **SS** signals chassis to start cycle sequence

Scorer start signal is sent to the CWC from scorer start switch or ball detect, pinfall information is sent from CWC to machine chassis

Sweep runs to first guard 66 degrees and stops when cam switch **SB** goes to the high dwell of the cam

SB also signals the chassis for a 3.5 sec delay for sweep run

Sweep run through, cam switch **SB** signals the table to spot at 186 degrees of sweep run

Sweep runs through and stops at 2nd guard when cam switch **SA** hits the high dwell of the cam

Spot solenoid is activated at table begins to run and spot pins, when cam switch **TA1** hits the high dwell it signals the sweep to run home

Sweep runs to the home position and stops home position when cam switch **SA** hits the low dwell of the cam

Table stops at the home position of 355 when cam switch **TA1** hits the low dwell of the cam

End of cycle, machine is ready for 1st ball

FIRST BALL FOUL

Ball sensor or **SS** signals chassis to start cycle sequence

Scorer start signal is sent to the CWC from scorer start switch or ball detect, FOUL signal sent from CWC to machine chassis

Sweep runs but does not stop at to first guard 66 degrees

No 3.5 sec delay for table run

Sweep runs through, at 186 degrees of sweep shaft rotation cam switch **SB** signals the table to spot, the sweep continues to run and stops at 2^{nd} guard when cam switch **SA** hits the high dwell of the cam

Table spot solenoid is activated and table spots pins providing the bin switch is closed, as cam switch **TA1** hits the high dwell of the cam it signals the sweep to run home

Sweep runs to the home position and stops home position when cam switch **SA** hits the low dwell of the cam

Table stops at the home position of 355 when cam switch **TA1** hits the low dwell of the cam

End of cycle, a full rack is set and the machine is on 2^{nd} ball

Note: If a foul occurs on 2^{nd} ball the machine will sweep and spot pins as usual, the scorer will score a foul and move to the next bowler

FIRST BALL OFF SPOT

Ball sensor or **SS** signals chassis to start cycle sequence

Sweep runs to first guard 66 degrees and stops when cam switch **SB** goes to the high dwell of the cam

Scorer start signal is sent to the CWC from scorer start switch or ball detect, pinfall information is sent from CWC to machine chassis

SB also signals the chassis for a 3.5 sec delay for table run

Table runs to feel for pins, when the table encounters the off spot pin the table stops moving, the table shaft continue to turn and the overtravel clevis pushes the off spot switch lever on the table torque tube that activates the **OS** switch

The **OS** switch signals the chassis to,

Stop the table at one shaft revolution,

Disable sweep run,

Switch the chassis to second ball logic.

The mechanic must clear the deadwood then run the sweep home by pressing the Sweep reverse ands sweep run switch at the same time.

End of cycle

Chassis

MP Chassis components

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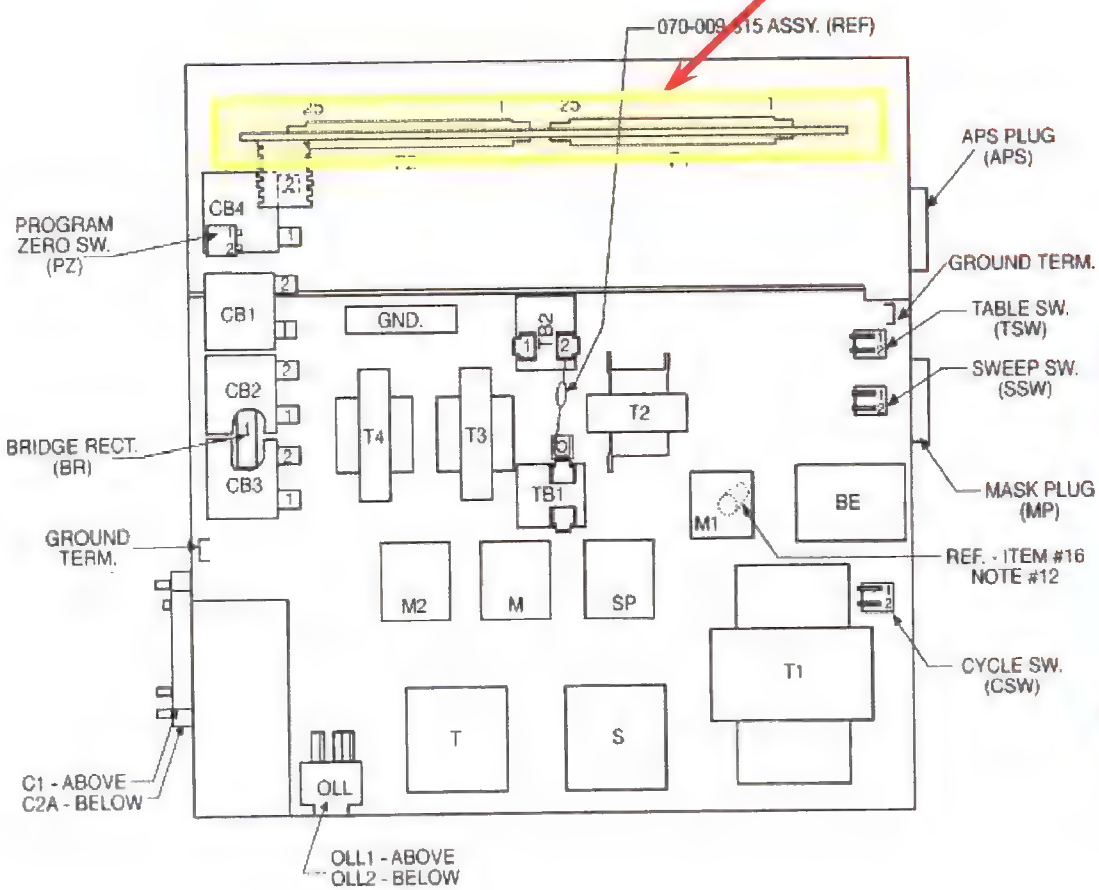
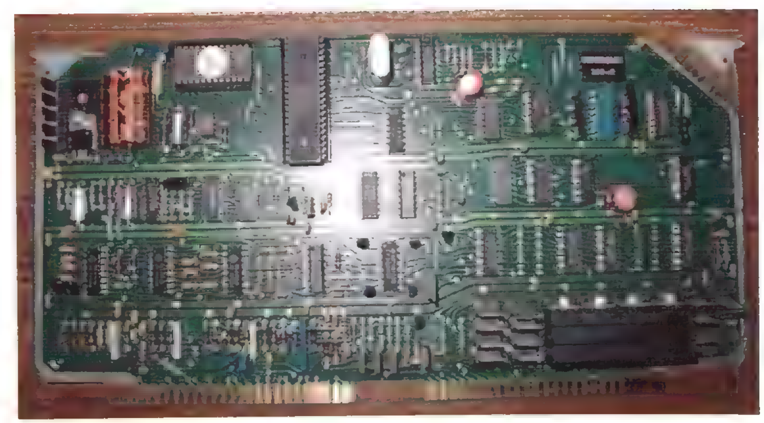


"MP circuit board"

Receives inputs from switches, controls relays



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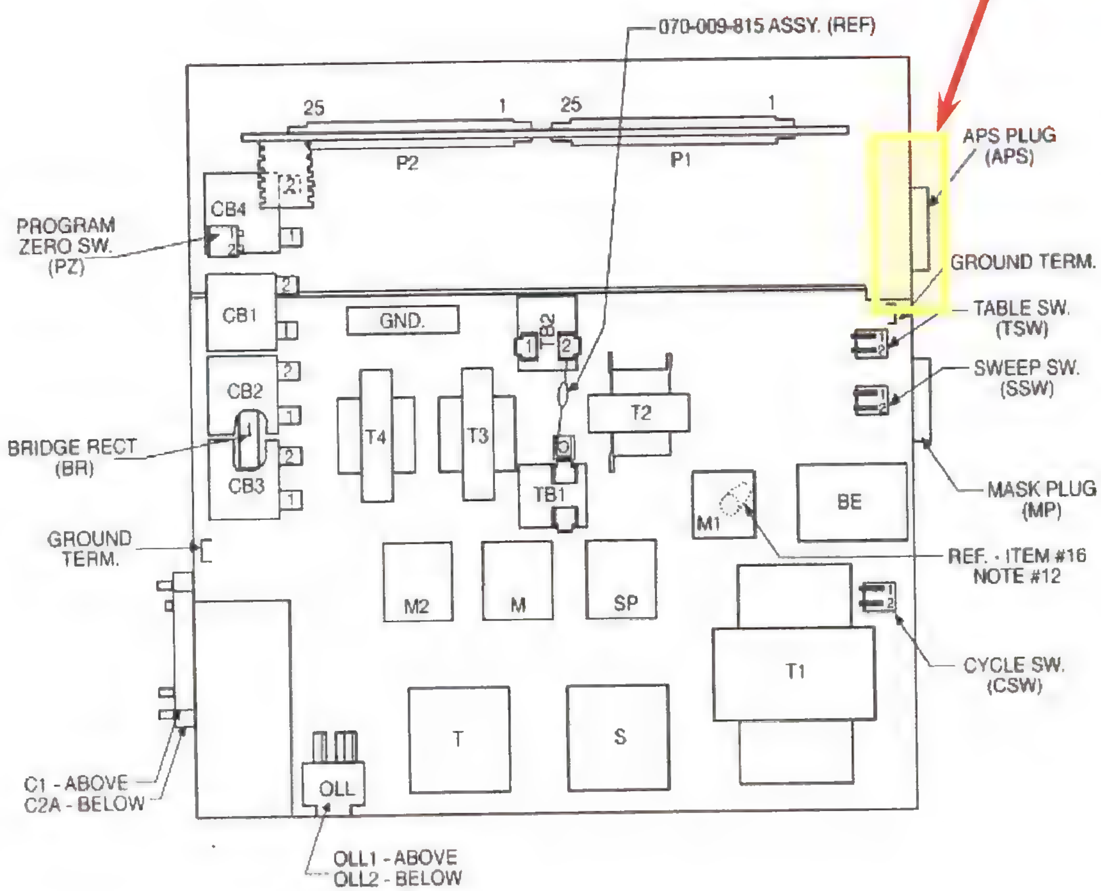

"APS Plug"

Inputs and outputs to AMF automatic scoring system

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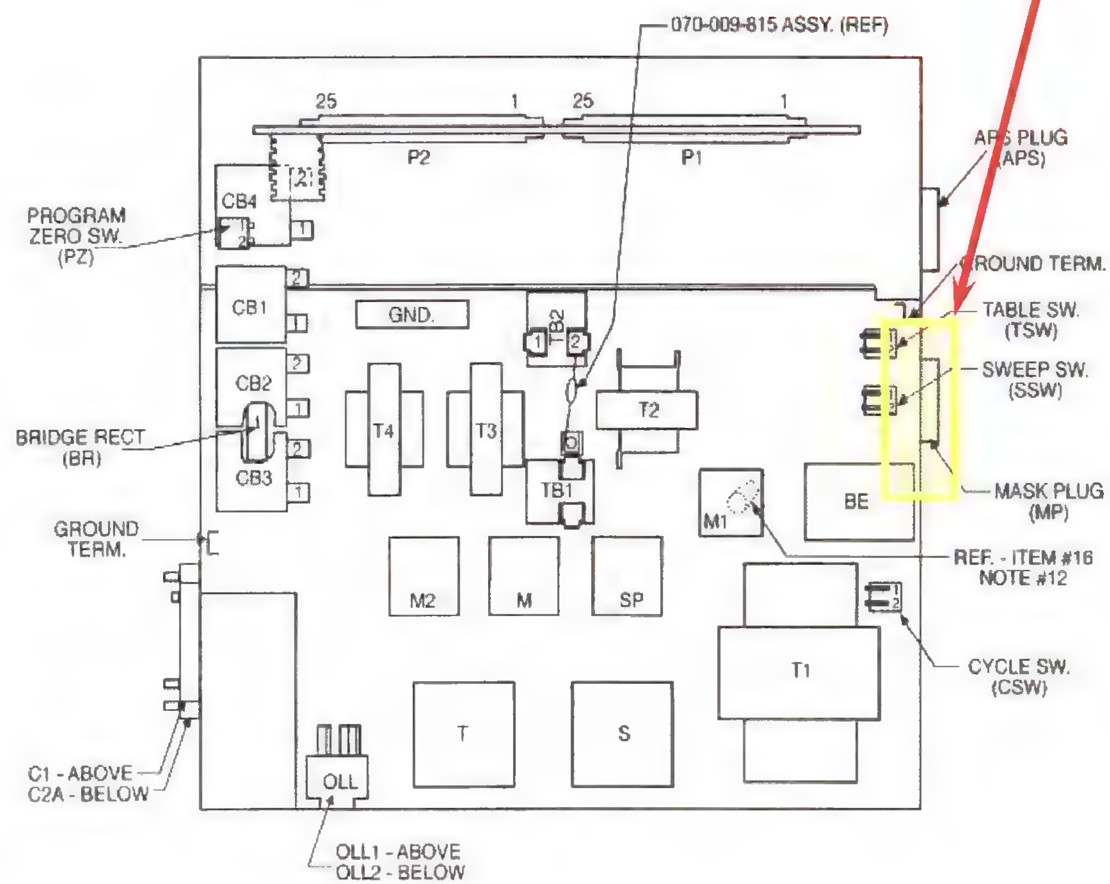

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"Mask Plug"

Outputs to AMF masking units

3

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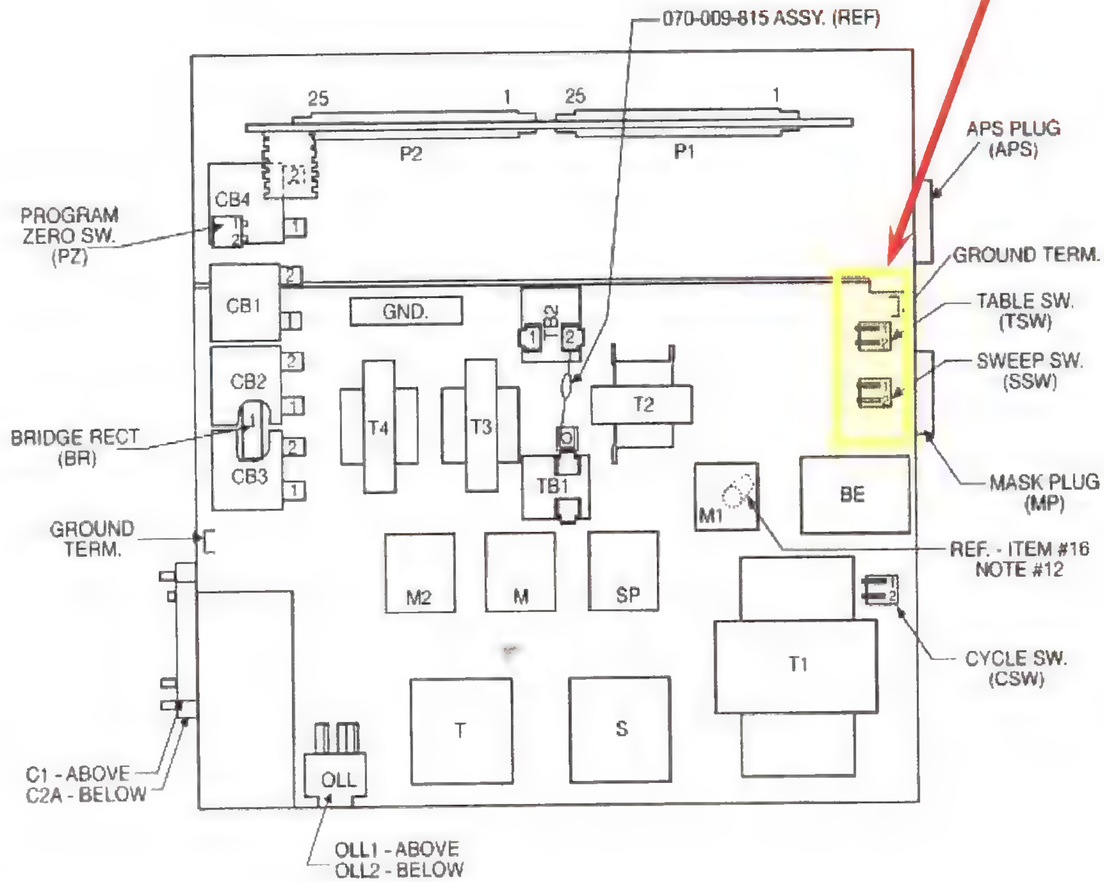
“Table and sweep run pushbuttons”

Manually run table or sweep motors



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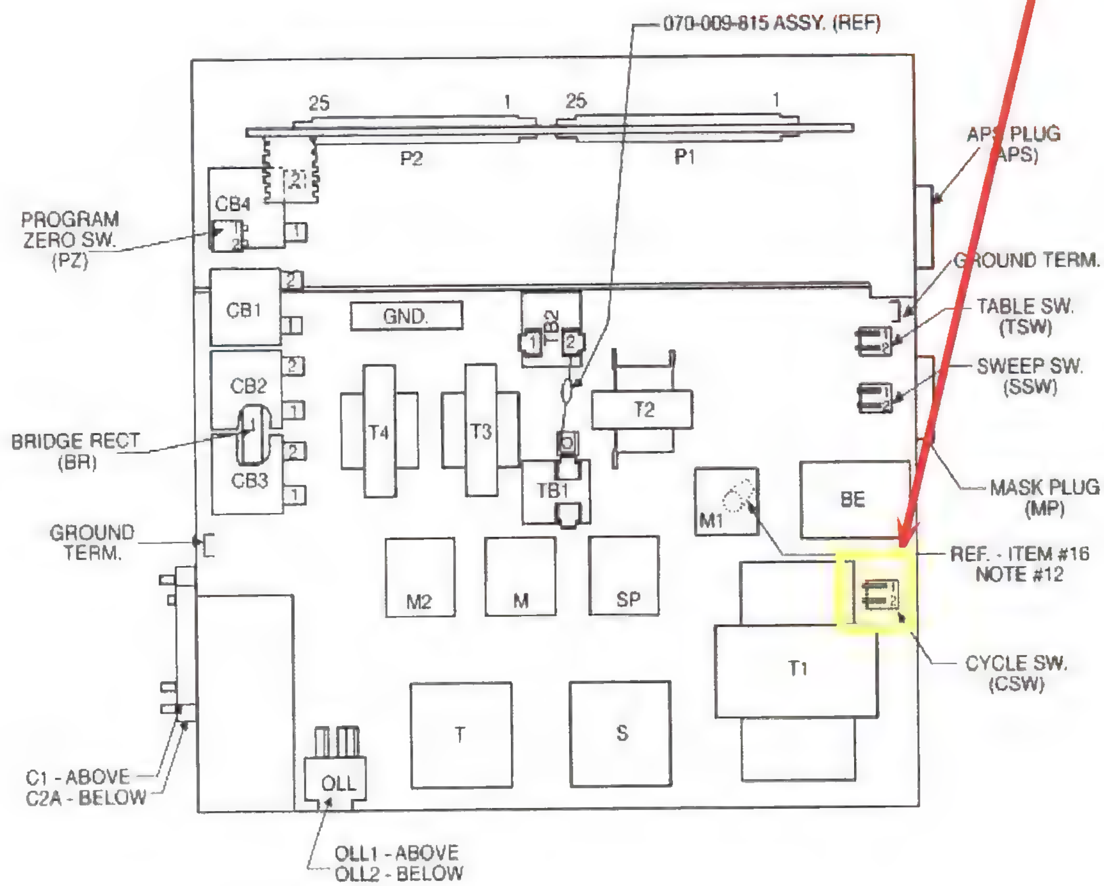
“Cycle pushbutton”

Cycles pinspotter



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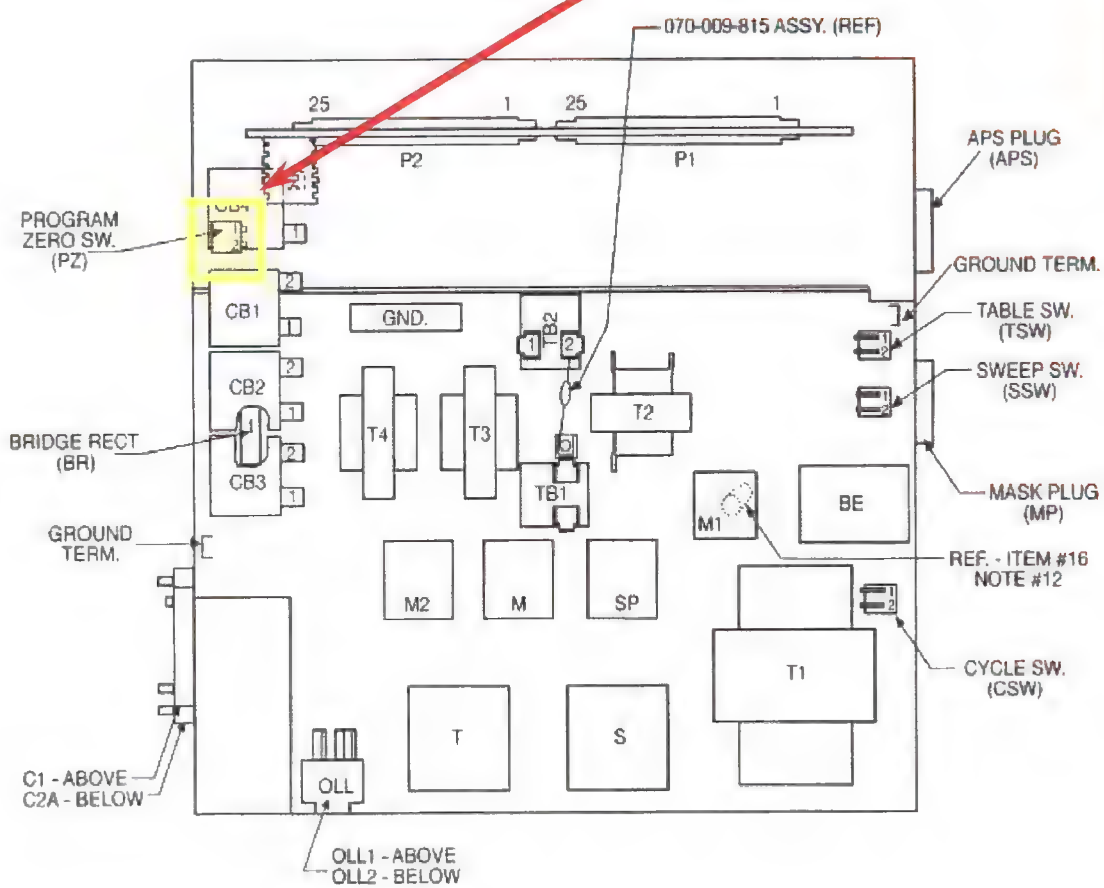

"Program zero pushbutton"

Resets the chassis, must be pushed to start the machine after unplugging the main power plug

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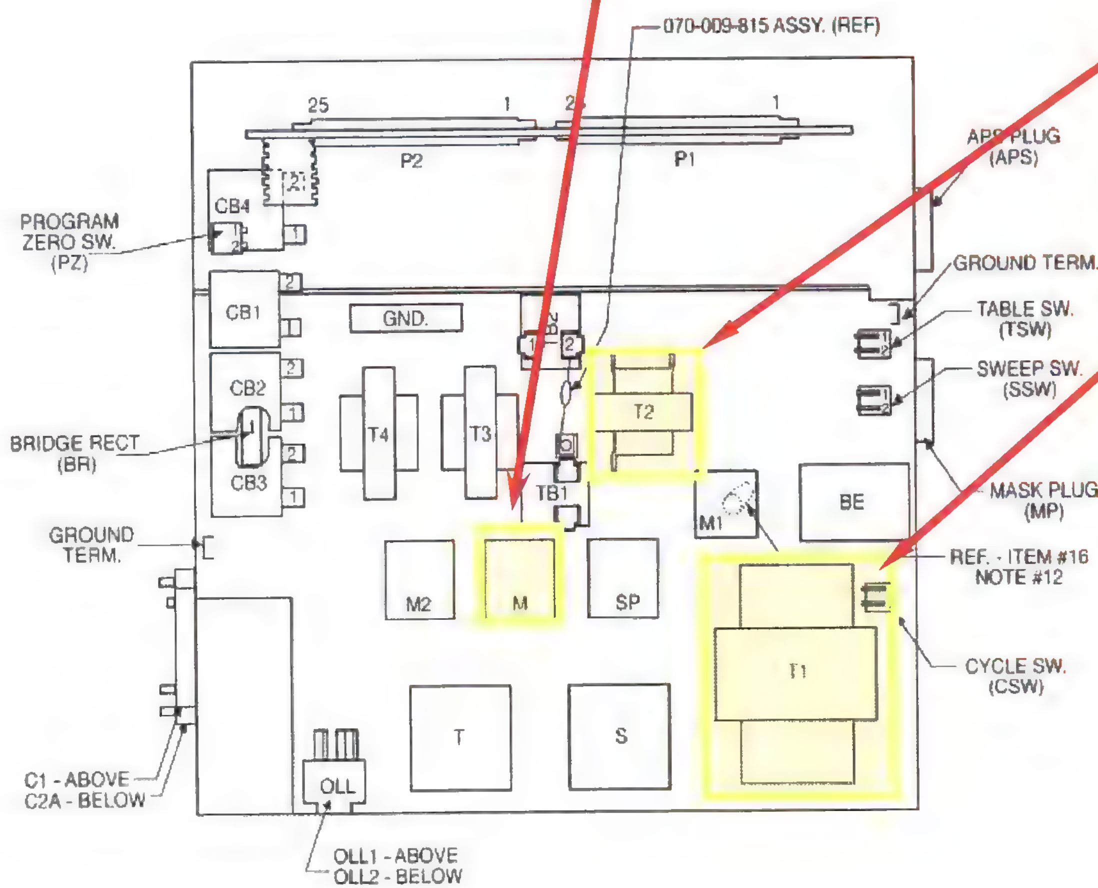

"M Relay"

Master control relay, it turns on machine using managers control circuit.

"M" receives its operating voltage of 24 VAC from transformer T2.

The switch contacts of the "M" relay provide 115 VAC to T1 transformer primary winding

M2, M, and SP are interchangeable on MP chassis, they are 3 pole double throw relays with 24 VAC coils

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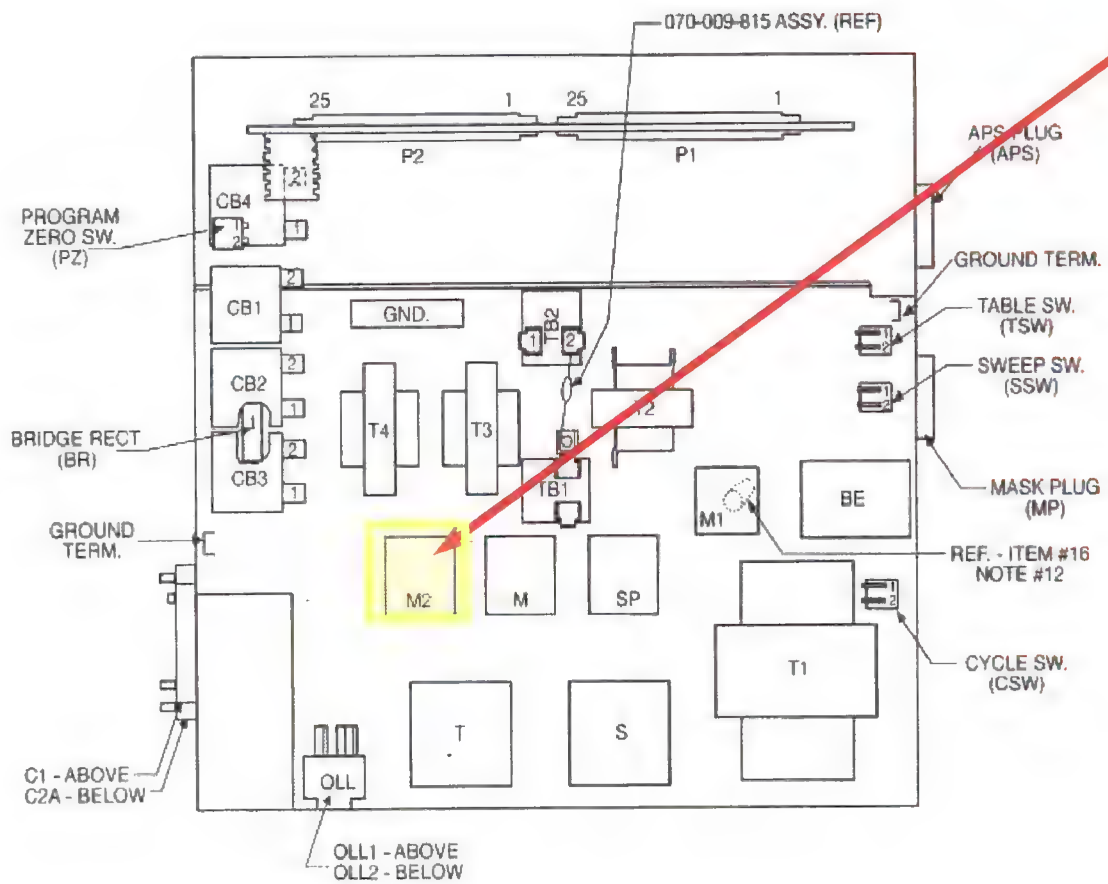
9800 MP CHASSIS WIRING



"M2 Relay"

Sweep reverse relay, allows automatic sweep reverse with automatic scoring

M2, M, and SP are interchangeable on MP chassis, they are 3 pole double throw relays with 24 VAC coils

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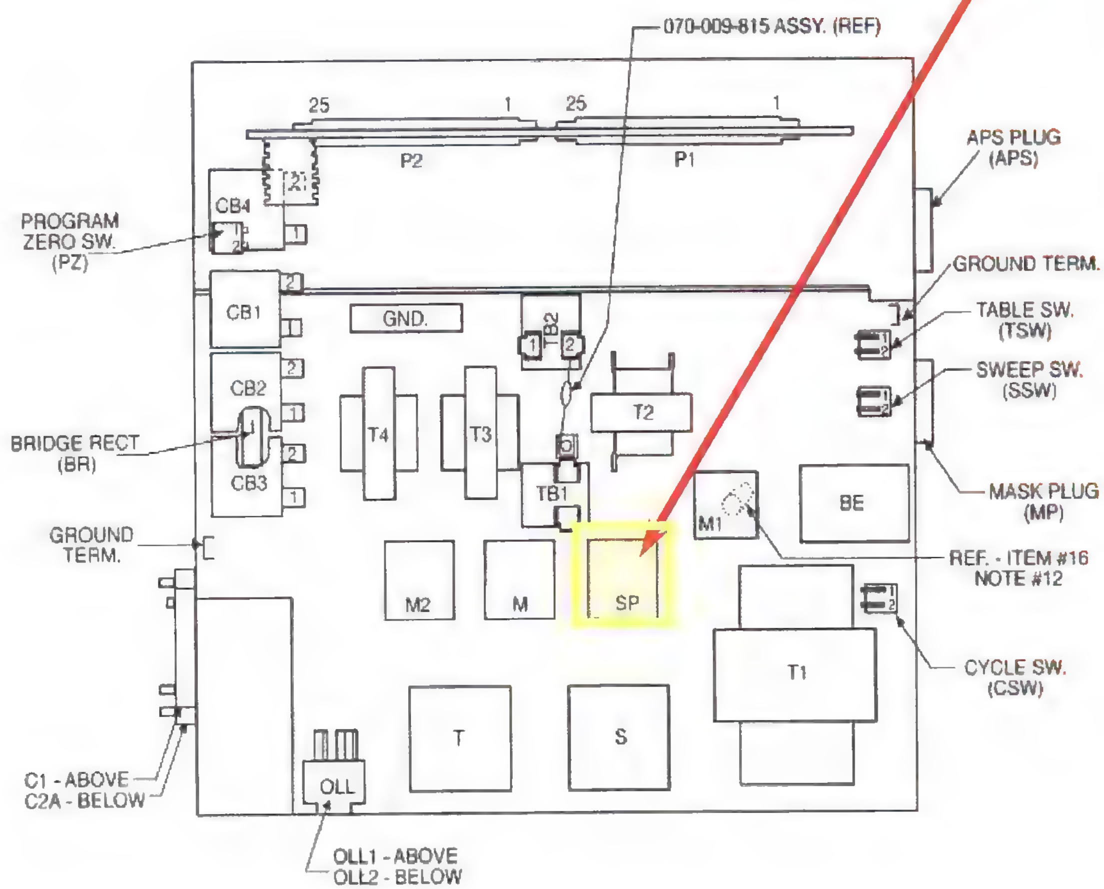
9800 MP CHASSIS WIRING



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"SP Relay"

Spot relay, operates spot (and respot solenoids), also activates frame meter

M2, M, and SP are interchangeable on MP chassis, they are 3 pole double throw relays with 24 VAC coils

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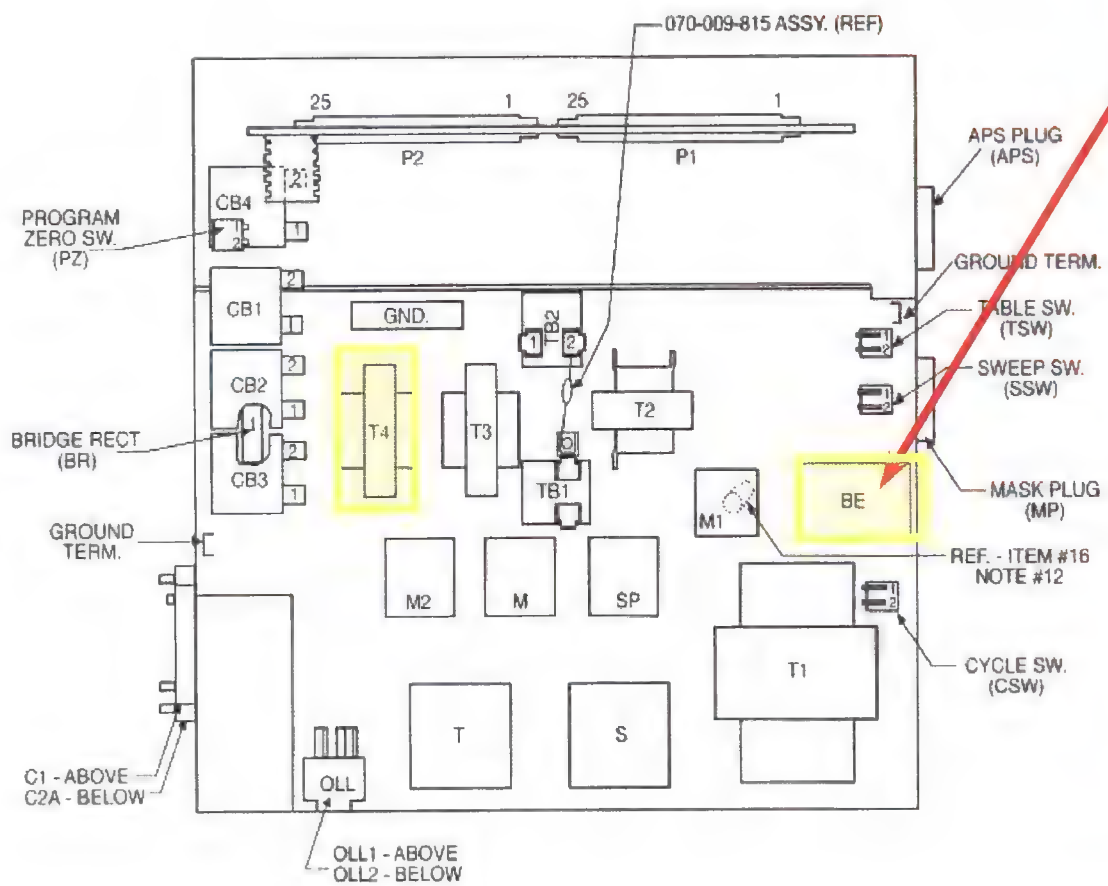
9800 MP CHASSIS WIRING



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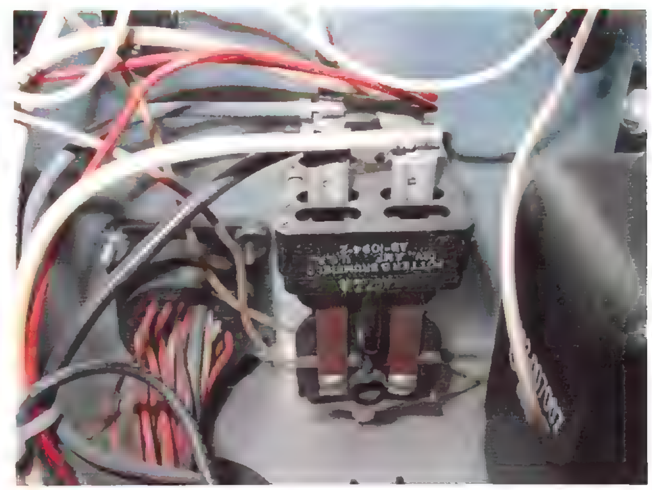
"BE Relay"

Back end motor relay, turns on back end motor (time delay through MP board)

The BE relay gets its coil voltage from transformer T4 (24 VAC)



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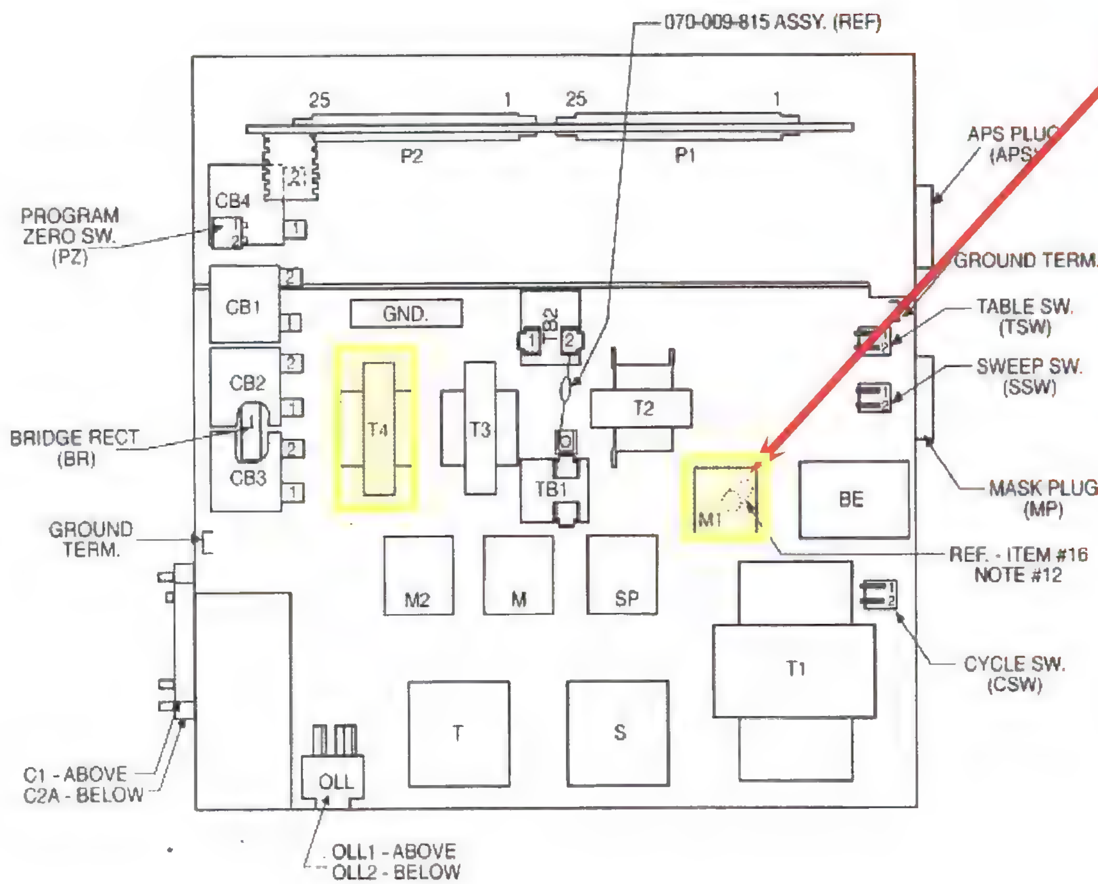
9800 MP CHASSIS WIRING

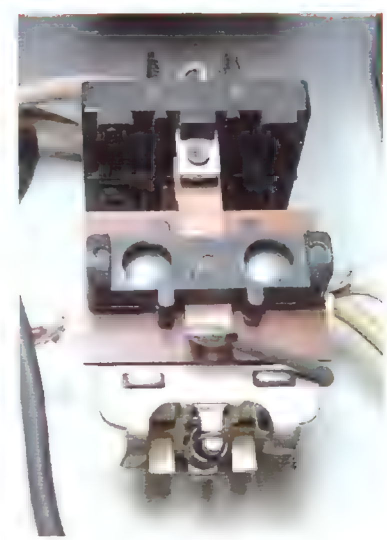


Pg 49

"M1 Relay"

Up front ball return relay, turns on front end ball return motor (time delay through MP board)

The M1 relay gets its coil voltage from transformer T4 (24 VAC)



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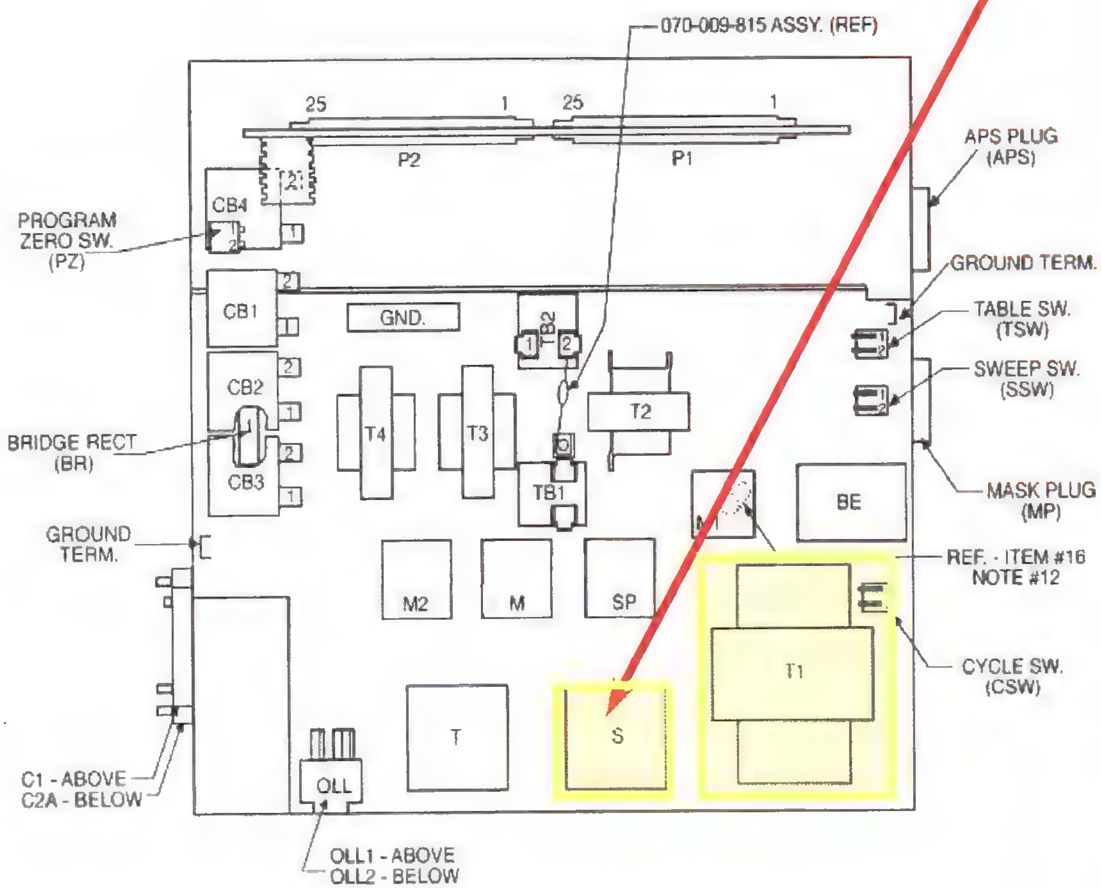

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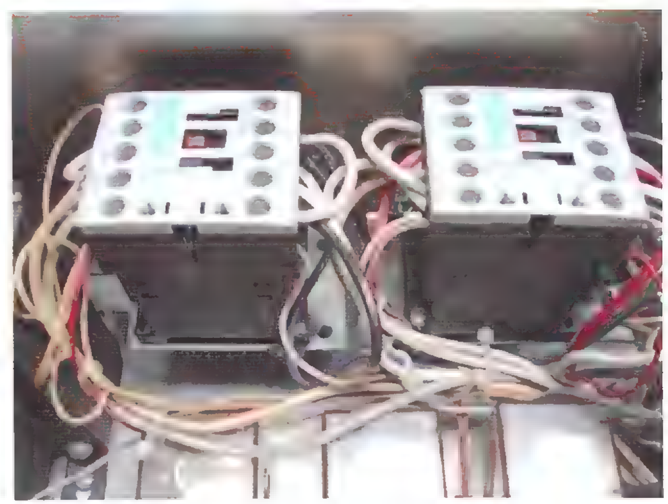
"S Relay"

Sweep motor relay, DPDT, N.O. contacts used for running, N.C. contacts used for braking.

The S relay gets its coil voltage from transformer T1 (24 VAC)



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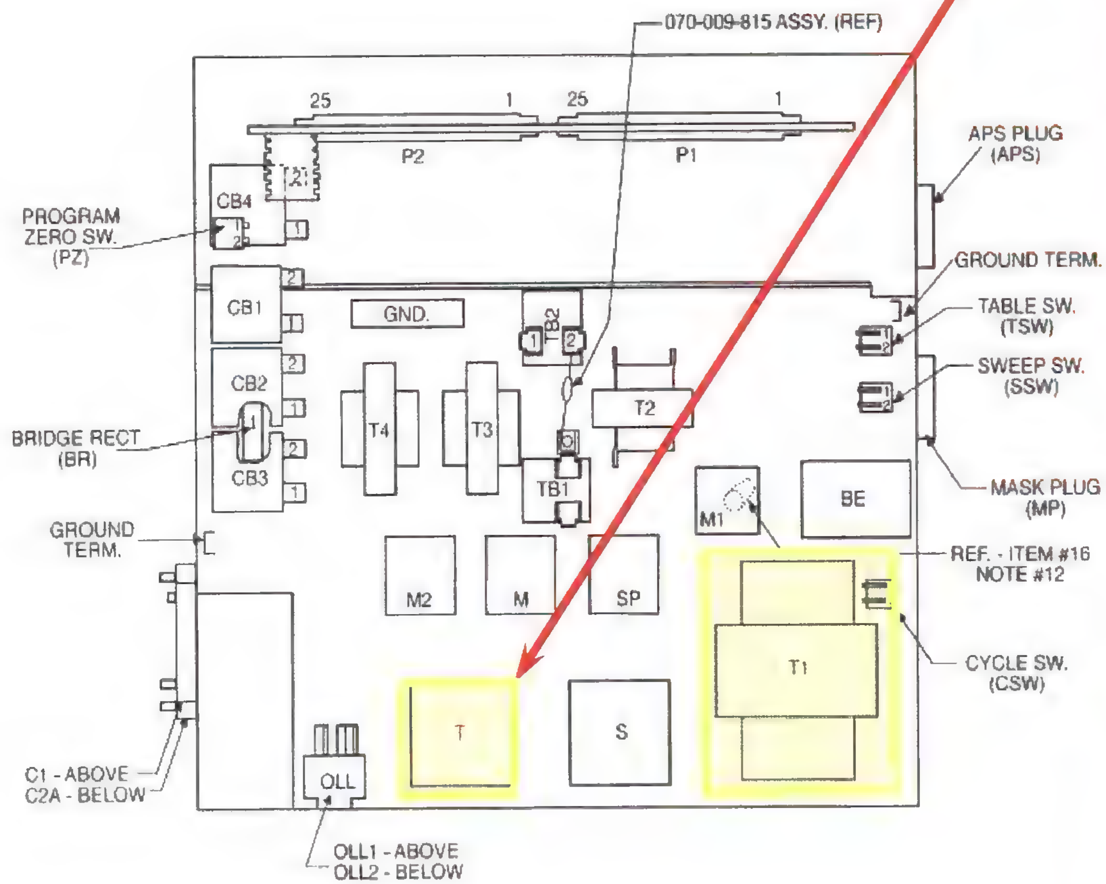
9800 MP CHASSIS WIRING

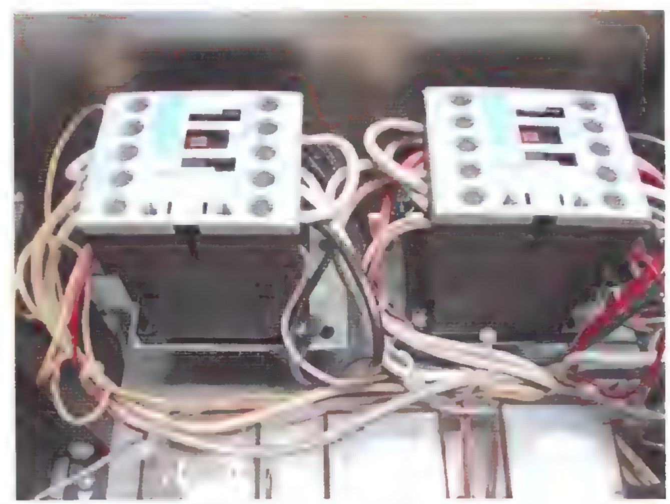


Pg 49

"T Relay"

Table motor relay, DPDT, N.O. contacts used for running, N.C. contacts used for braking.

The T relay gets its coil voltage from transformer T1 (24 VAC)



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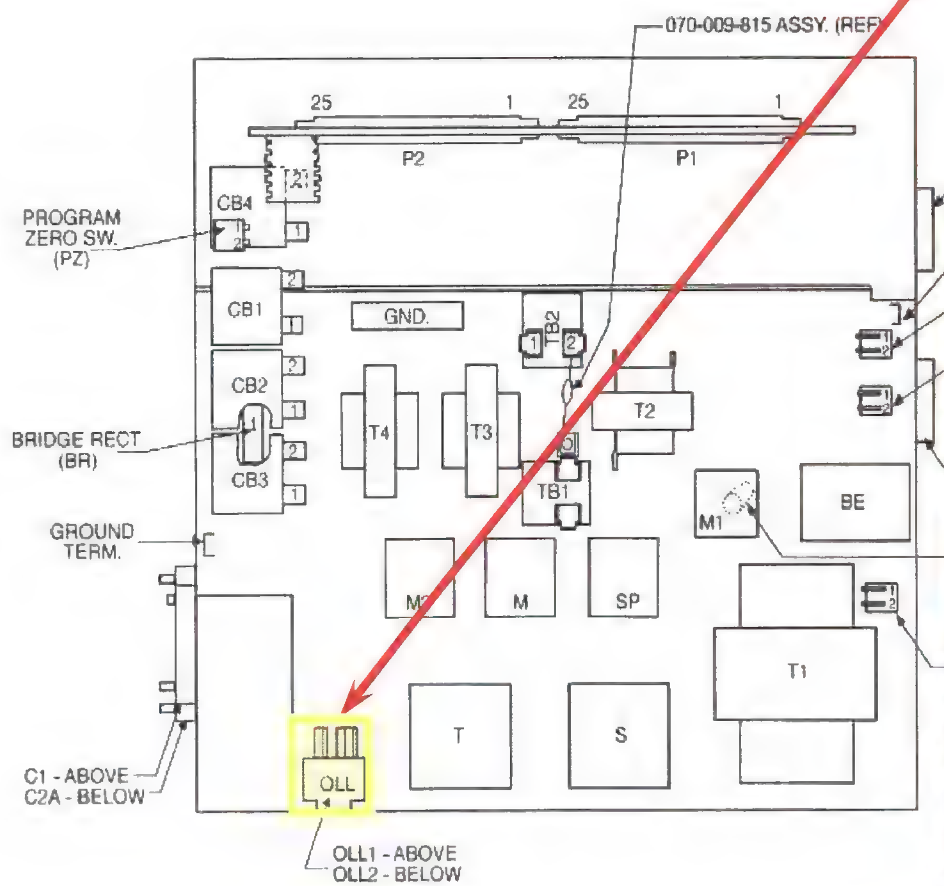
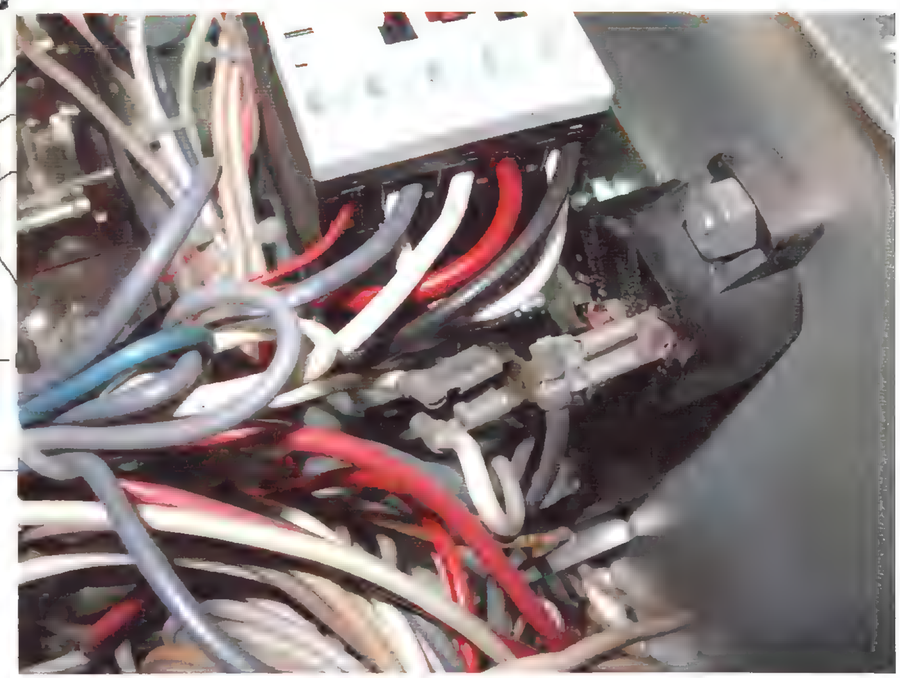
9800 MP CHASSIS WIRING





"Klixon"

OLL #1 sparemaker lights

OLL #2 1&2 ball, strike, and foul indicator lamps on masking unit.

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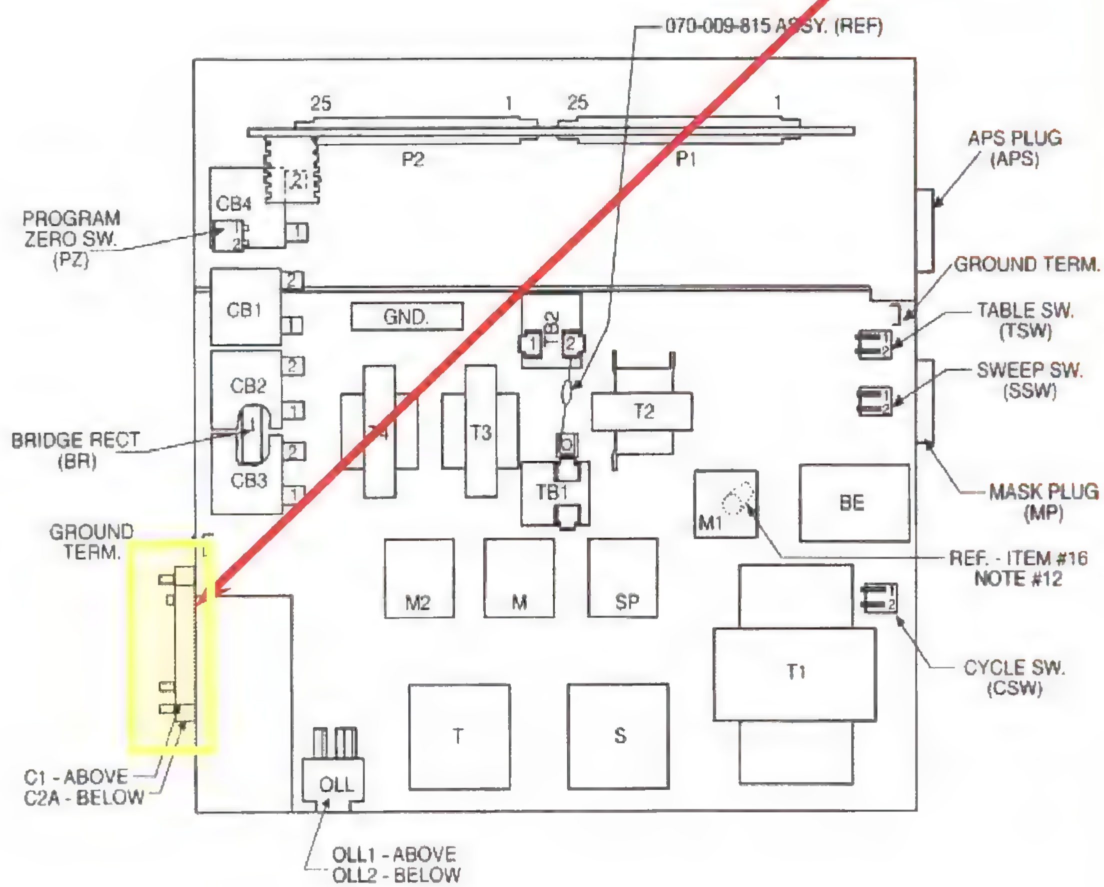
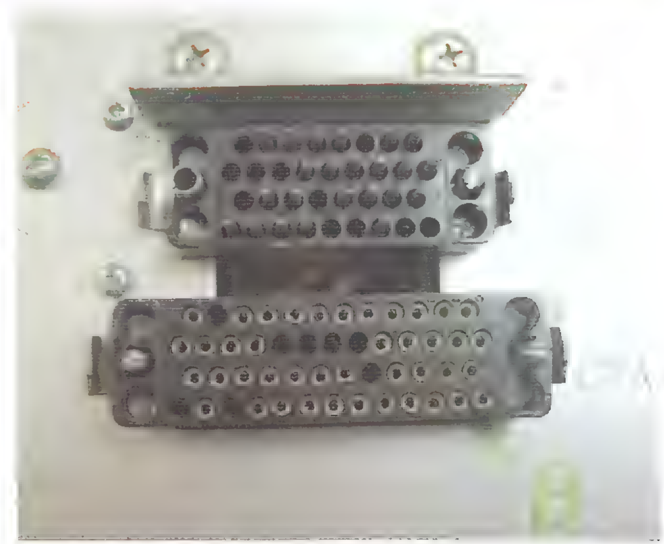
9800 MP CHASSIS WIRING



"C1 and C2A plugs"

C1- high voltage connections for the motors and solenoids to the chassis.

C2A- low voltage connection for control switches to the chassis.



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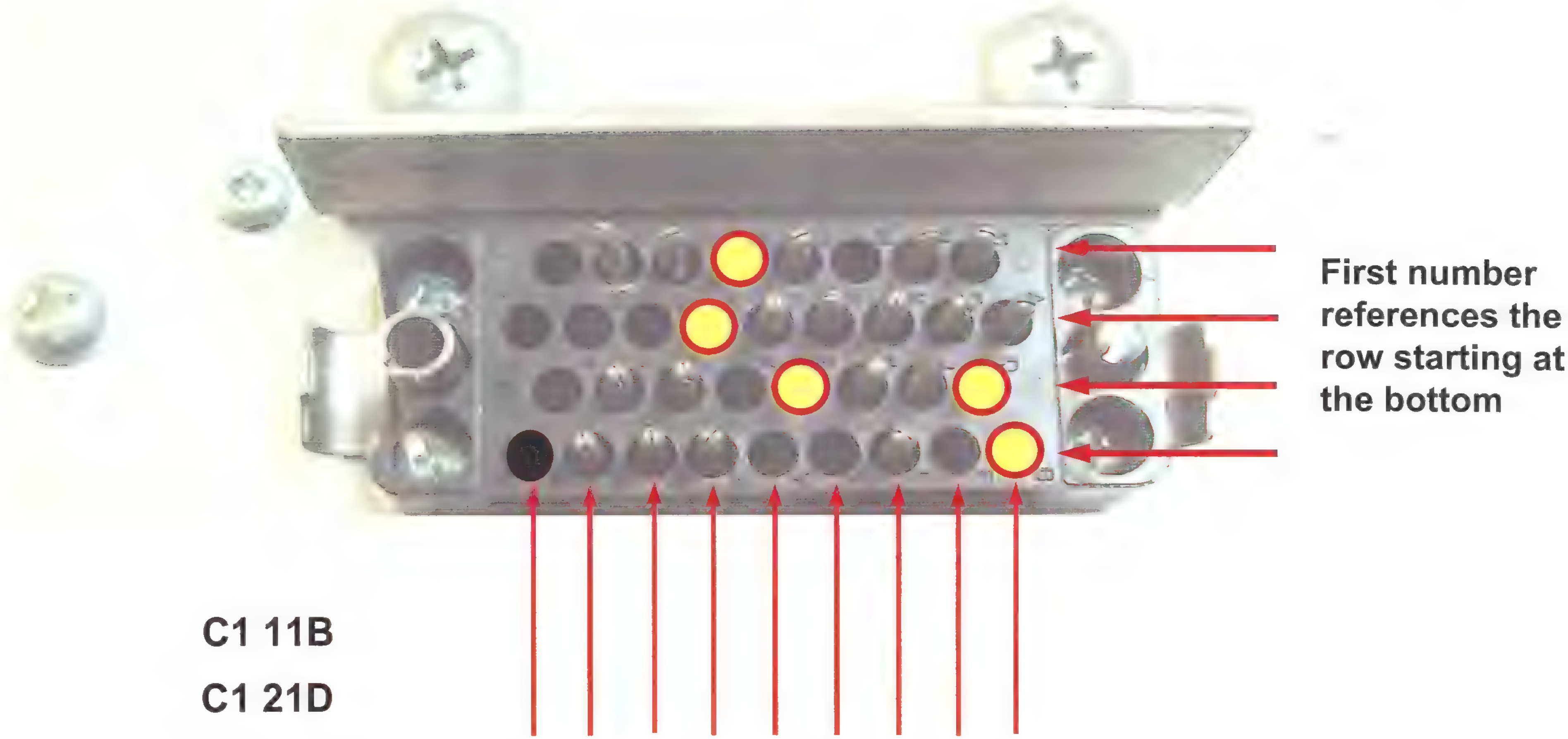
"B" terminal

BBB

On the bottom

Closest to bowlers



C1 11B

C1 21D

C1 24 T

C1 36 Y

C1 45 W

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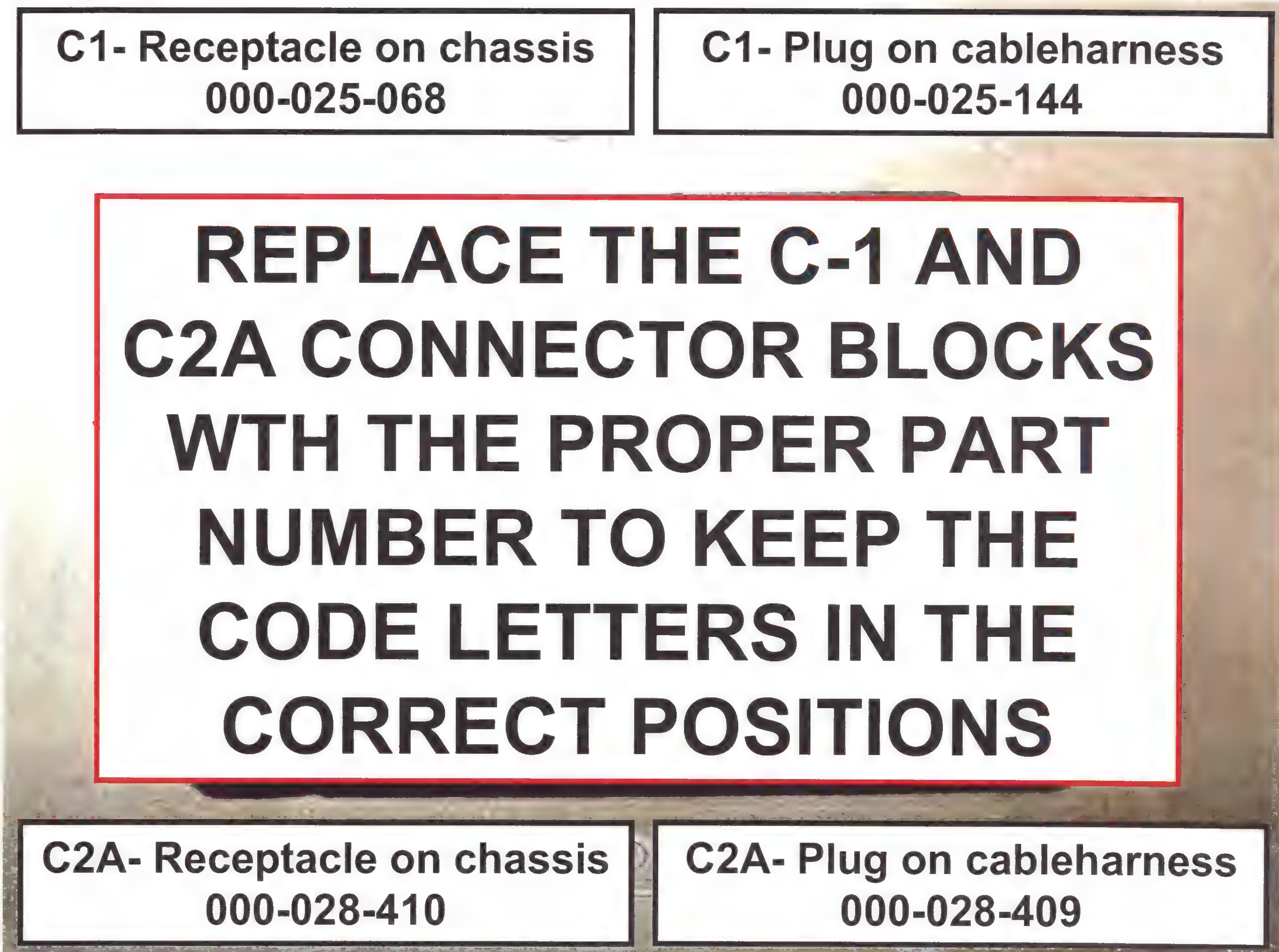
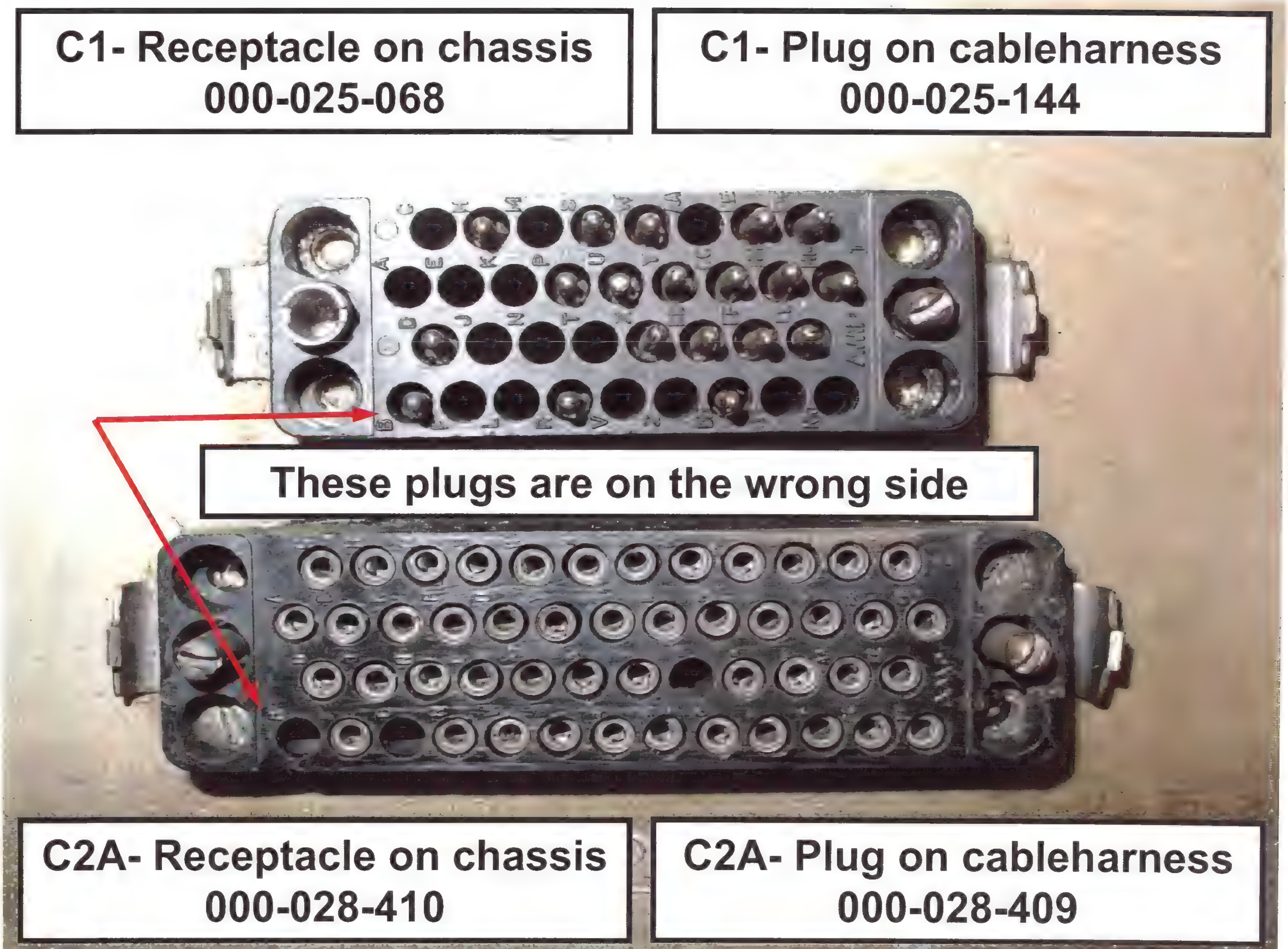
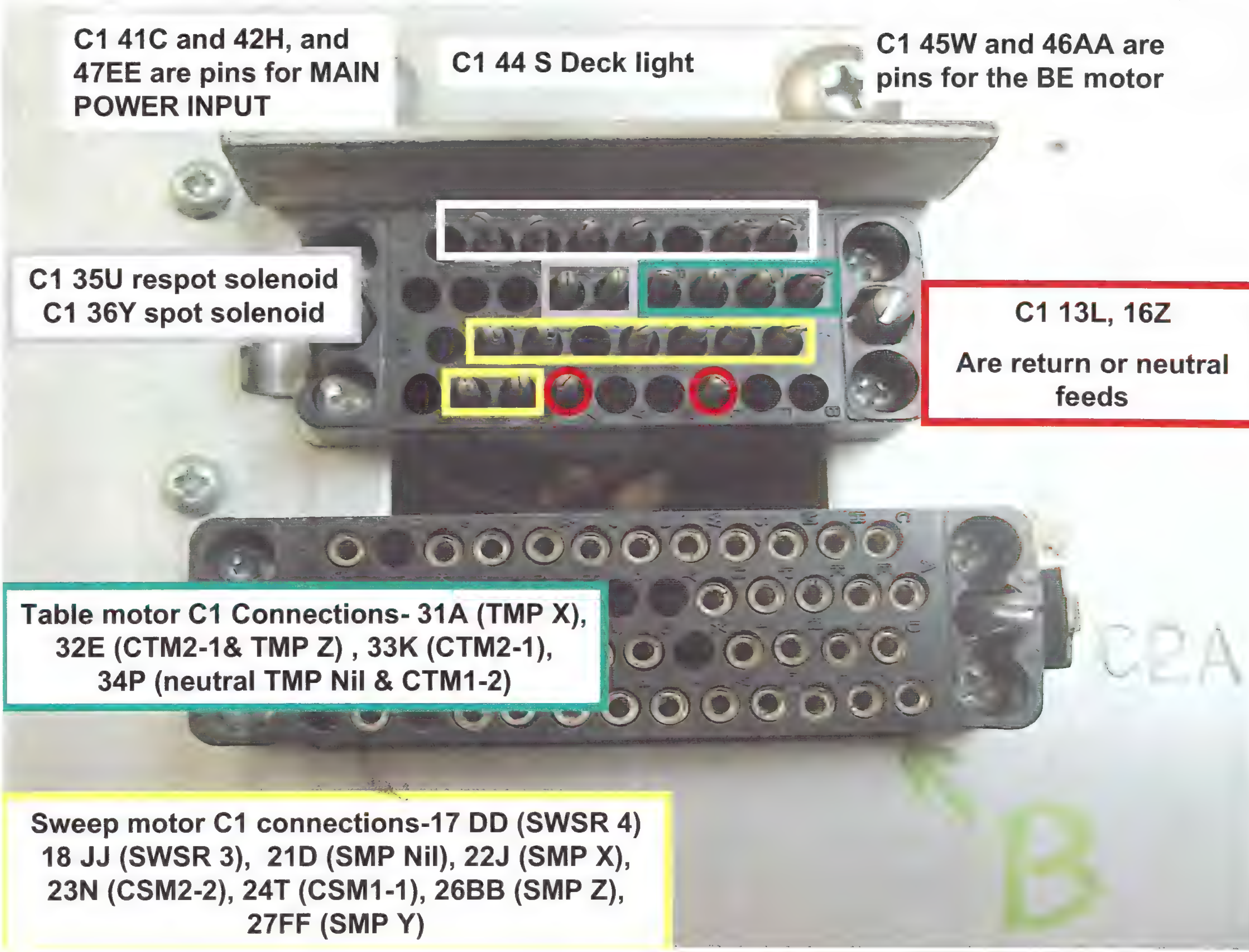

C1- Receptacle on chassis
000-025-068
C1- Plug on cableharness
000-025-144
REPLACE THE C-1 AND C2A CONNECTOR BLOCKS WTH THE PROPER PART NUMBER TO KEEP THE CODE LETTERS IN THE CORRECT POSITIONS
C2A- Receptacle on chassis
000-028-410
C2A- Plug on cableharness
000-028-409


C1- Receptacle on chassis
000-025-068
C1- Plug on cableharness
000-025-144
These plugs are on the wrong side
C2A- Receptacle on chassis
000-028-410
C2A- Plug on cableharness
000-028-409

19


C1 41C and 42H, and
47EE are pins for MAIN
POWER INPUT
C1 44 S Deck light
C1 45W and 46AA are
pins for the BE motor
C1 35U respot solenoid
C1 36Y spot solenoid
C1 13L, 16Z
Are return or neutral
feeds
Table motor C1 Connections- 31A (TMP X),
32E (CTM2-1& TMP Z) , 33K (CTM2-1),
34P (neutral TMP Nil & CTM1-2)
Sweep motor C1 connections-17 DD (SWSR 4)
18 JJ (SWSR 3), 21D (SMP Nil), 22J (SMP X),
23N (CSM2-2), 24T (CSM1-1), 26BB (SMP Z),
27FF (SMP Y)
C2A
B

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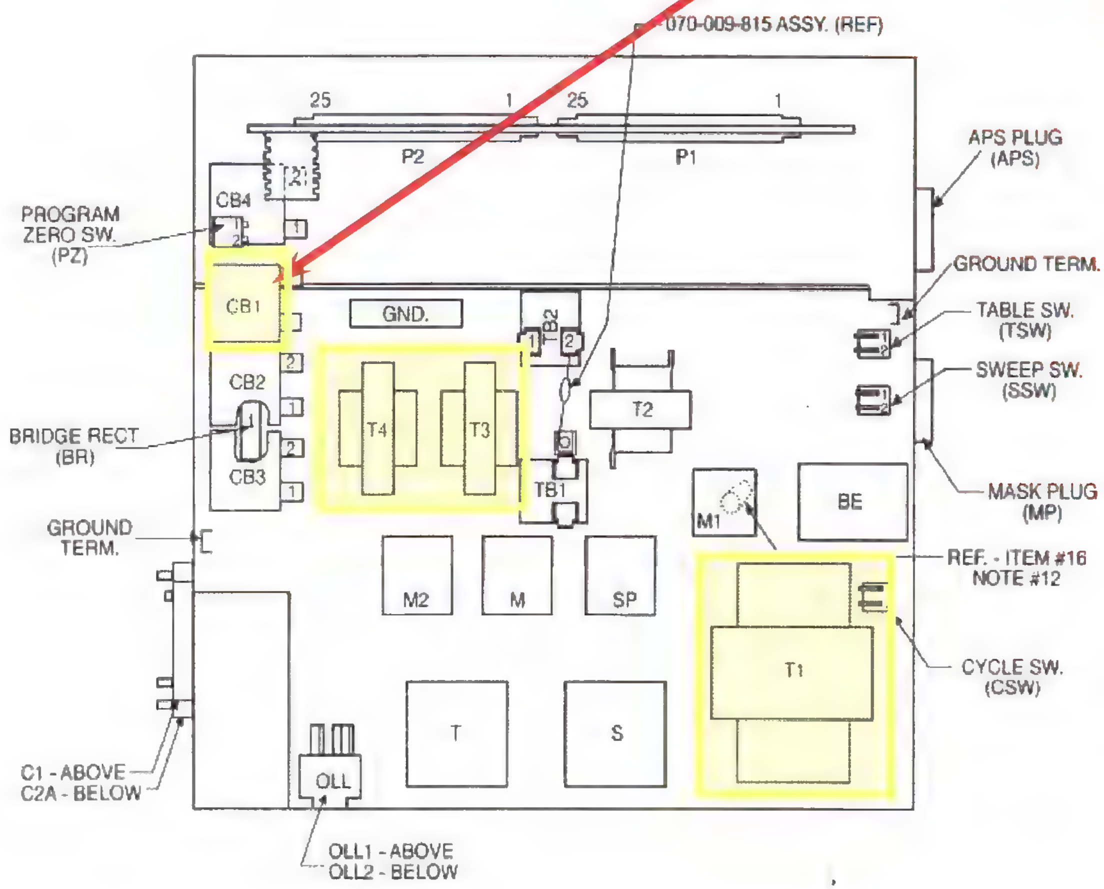

"CB 1"

CB 1- protects transformers T1, T3, and T4 primary windings (115 VAC).

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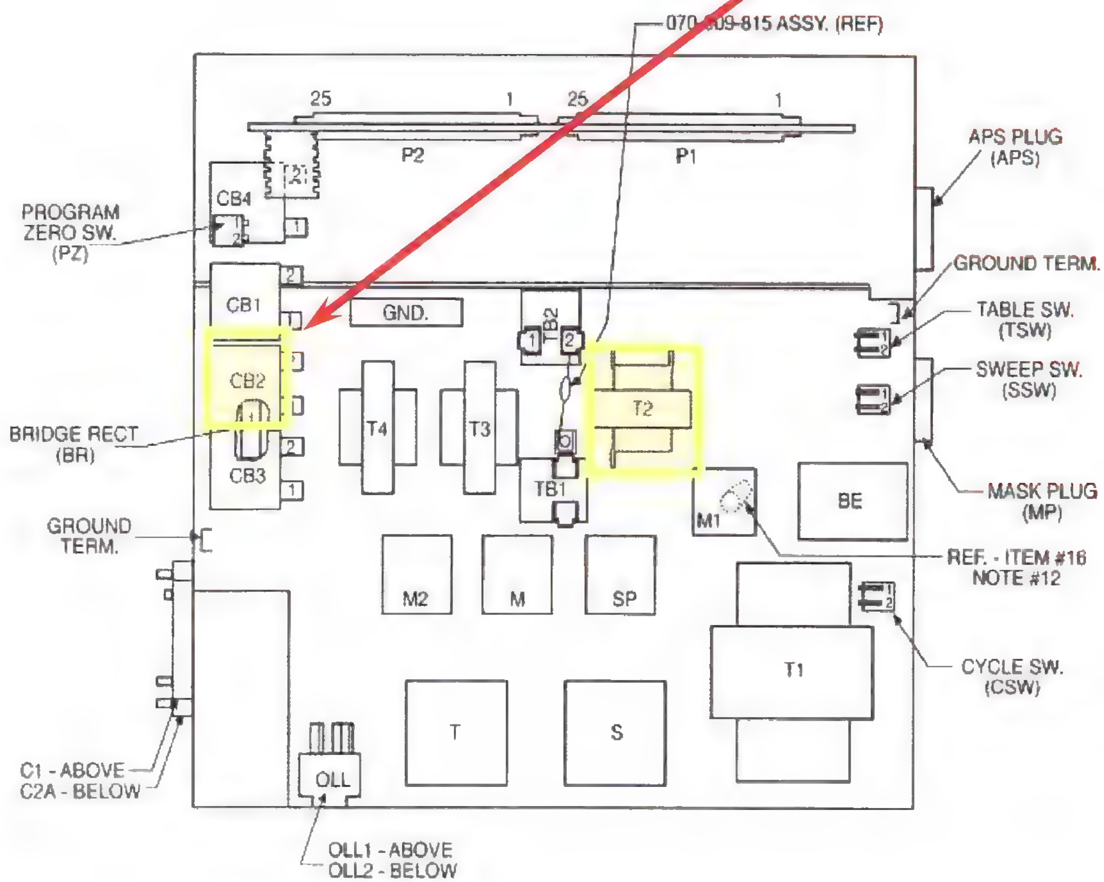
9800 MP CHASSIS WIRING

"CB 2"

CB 2- protects transformer T2 primary windings (115 VAC).



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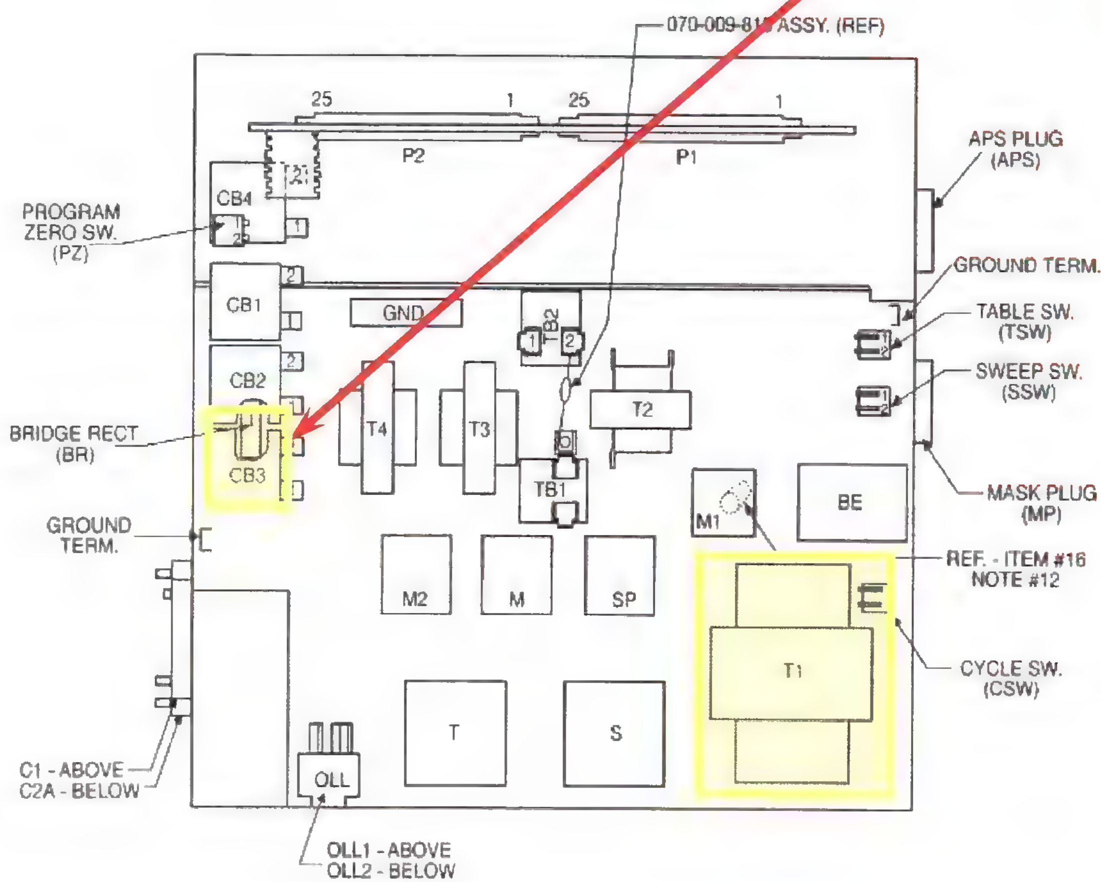
PINSPOTTER TRAINING

9800 MP CHASSIS WIRING

"CB 3"

CB 3- protects transformer T1 secondary windings (24 VAC).



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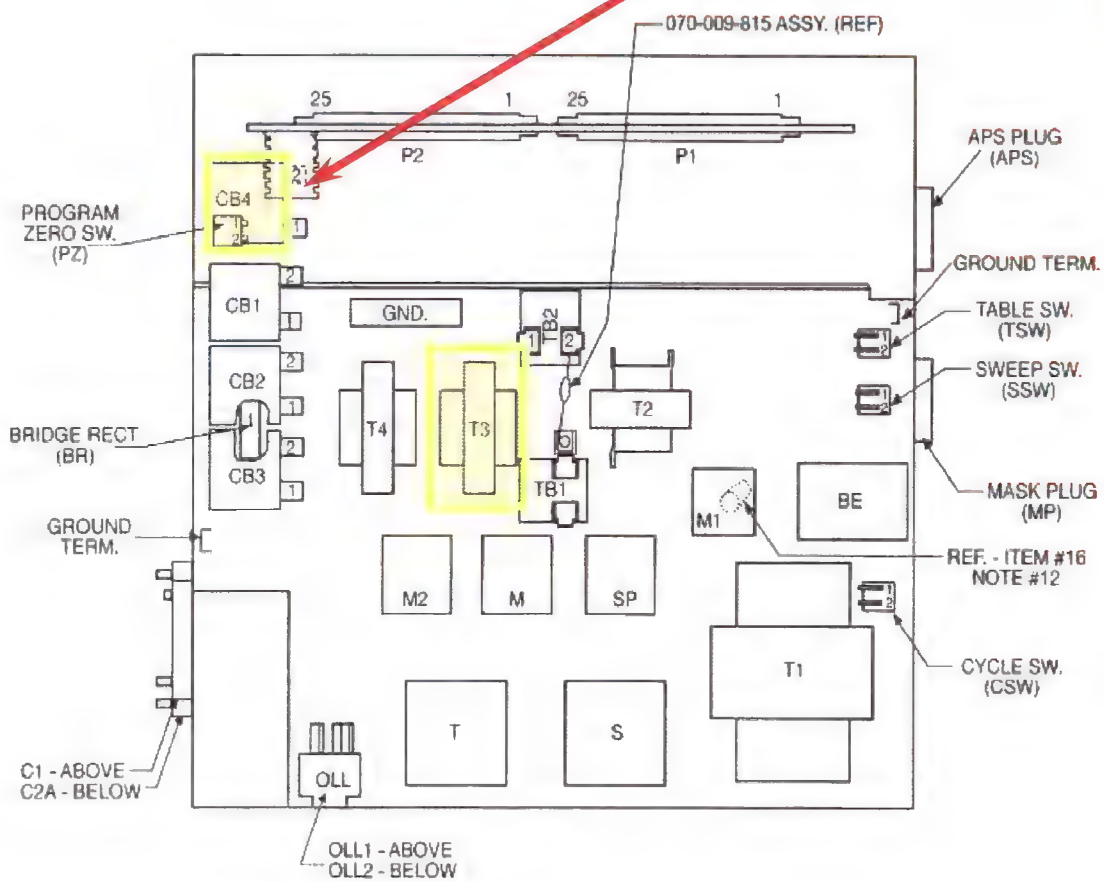
9800 MP CHASSIS WIRING

"CB 4"

CB 4- protects transformer T3 secondary windings (24 VAC).



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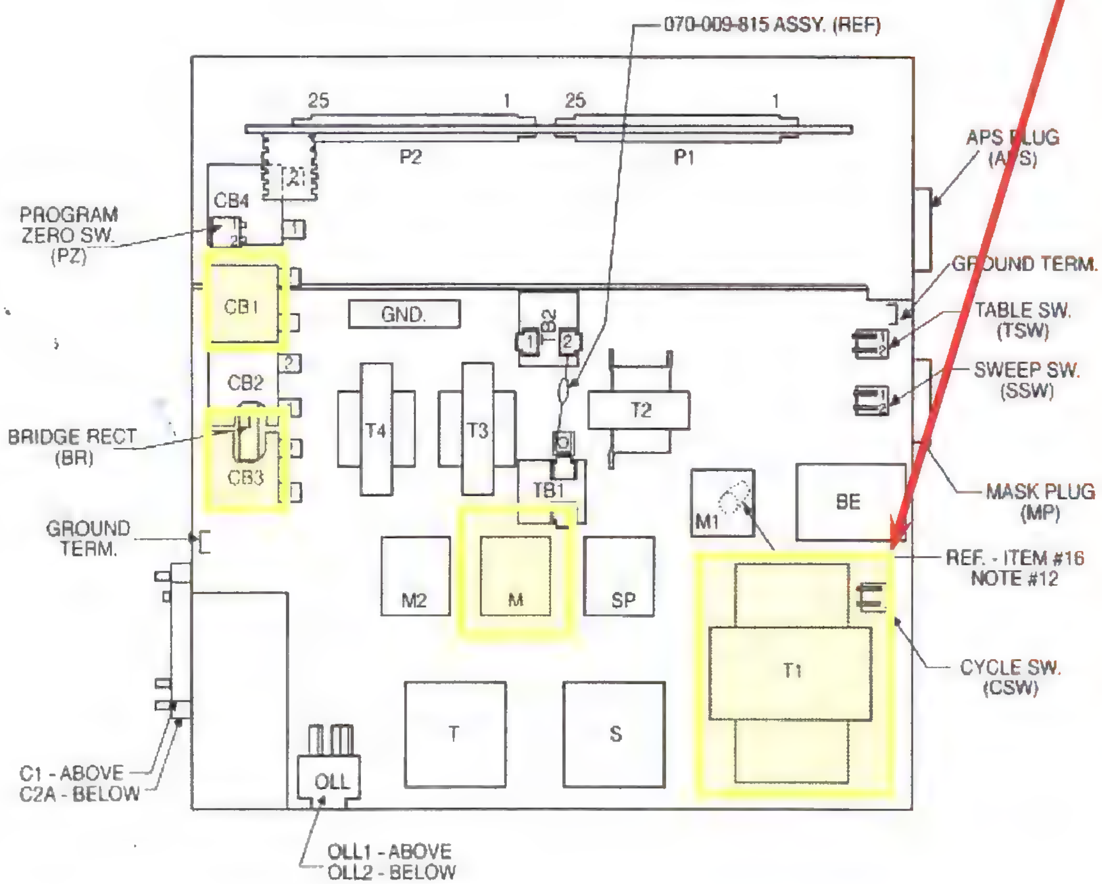
9800 MP CHASSIS WIRING



Pg 49

"T1"

Transformer T1 provides various voltages for chassis operation and voltages for the S and T relay coils.

T1 is turned on when the "M" relay energizes

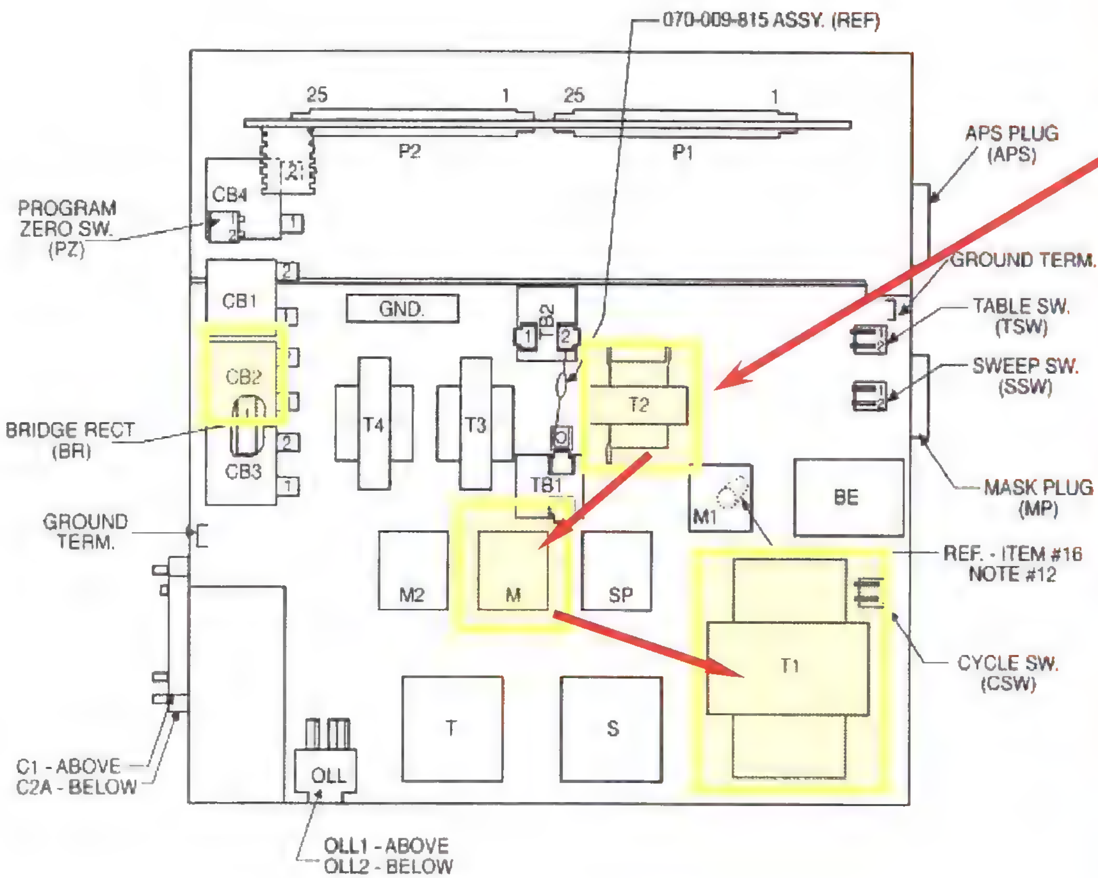
T1 primary winding is protected by CB1 and CB on the rear control panel.

T1 secondary winding is protected by CB 3

25

AMF BOWLING INC.
PINSPOTTER TRAINING

9800 MP CHASSIS WIRING



Pg 49

"T2"

Transformer T2 provides voltage for the managers control circuit.

The managers control circuit is used to turn on relay "M" which turns on transformer T1

T2 primary winding is protected by CB 2

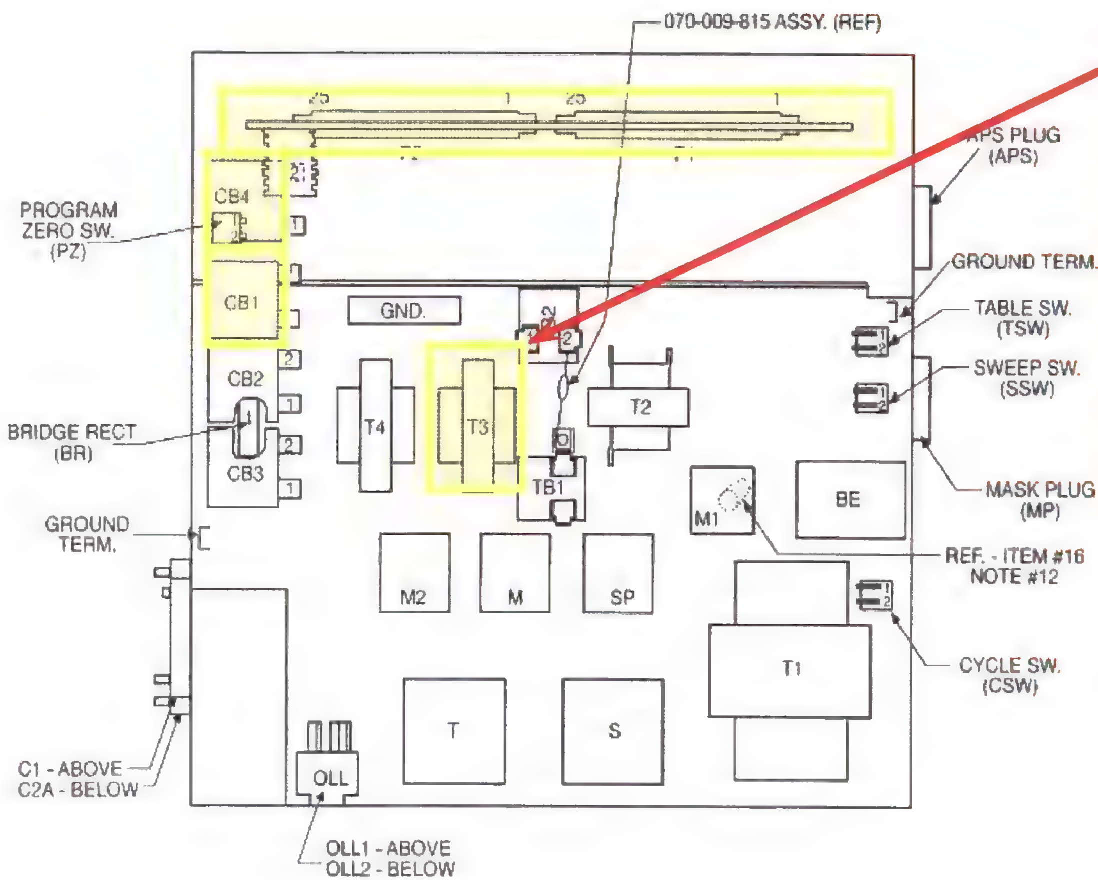
T2 secondary is protected by CB on the rear control box

T2 is always powered up when the main power plug is installed

26

AMF BOWLING INC.
PINSPOTTER TRAINING

9800 MP CHASSIS WIRING



Pg 49

"T3"

Transformer T3 provides voltage for the circuit board.

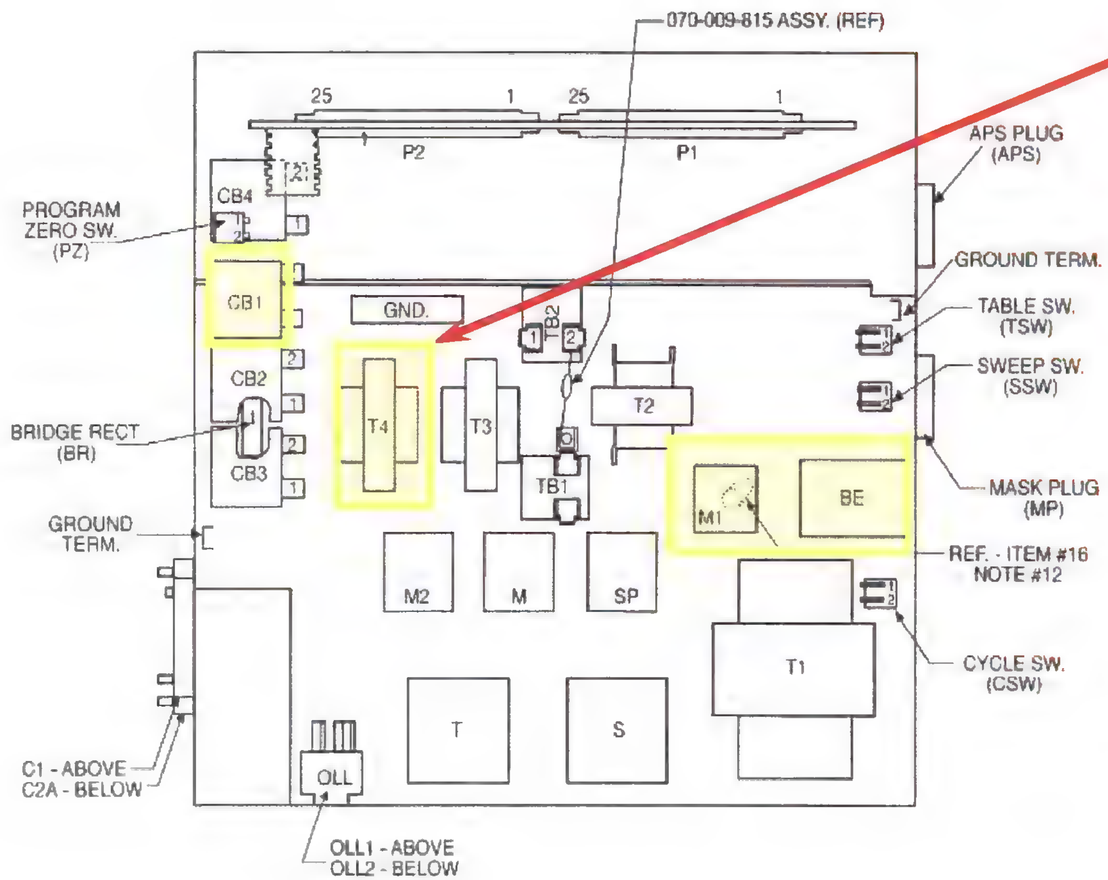
T3 primary winding is protected by CB 1

T3 secondary winding is protected by CB 4

T3 is always powered up when the main power plug is installed

AMF BOWLING INC.
PINSPOTTER TRAINING

9800 MP CHASSIS WIRING



Pg 49

"T4"

Transformer T4 provides voltage for the M1 and BE relays.

T4 primary winding is protected by CB 1

T4 is always powered up when the main power plug is installed

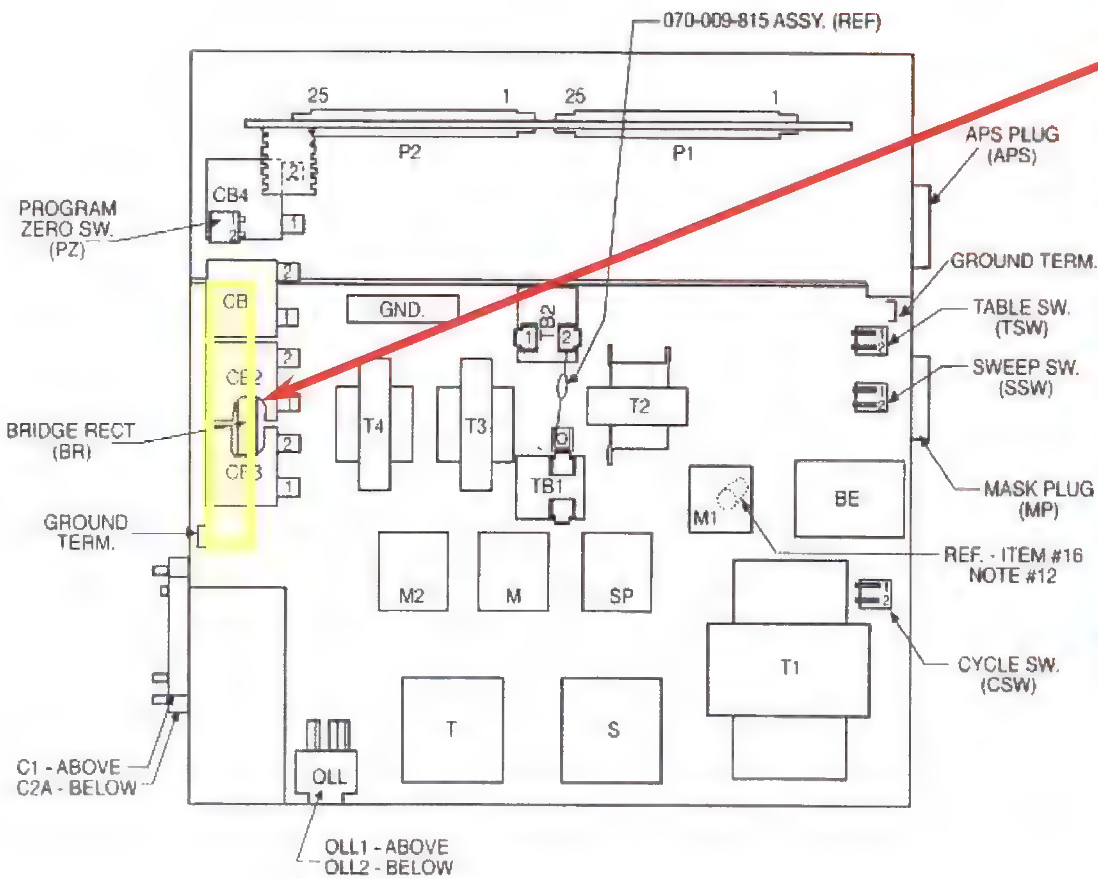
28

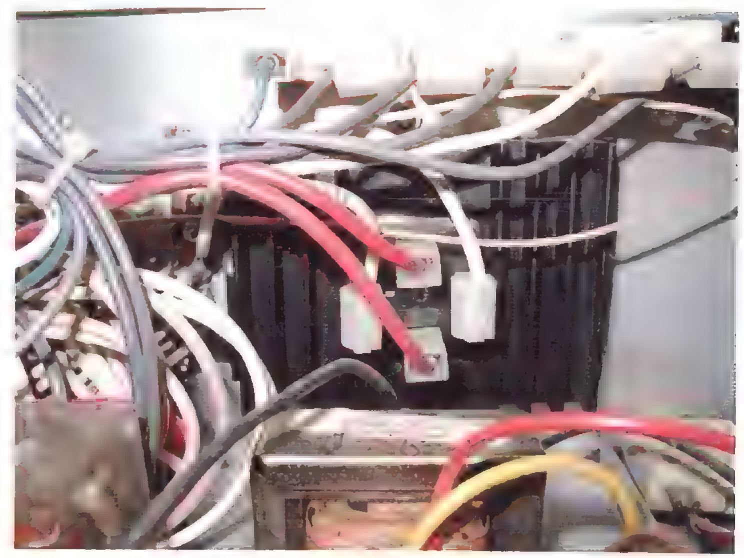
AMF BOWLING INC.
PINSPOTTER TRAINING

9800 MP CHASSIS WIRING

"Bridge rectifier"

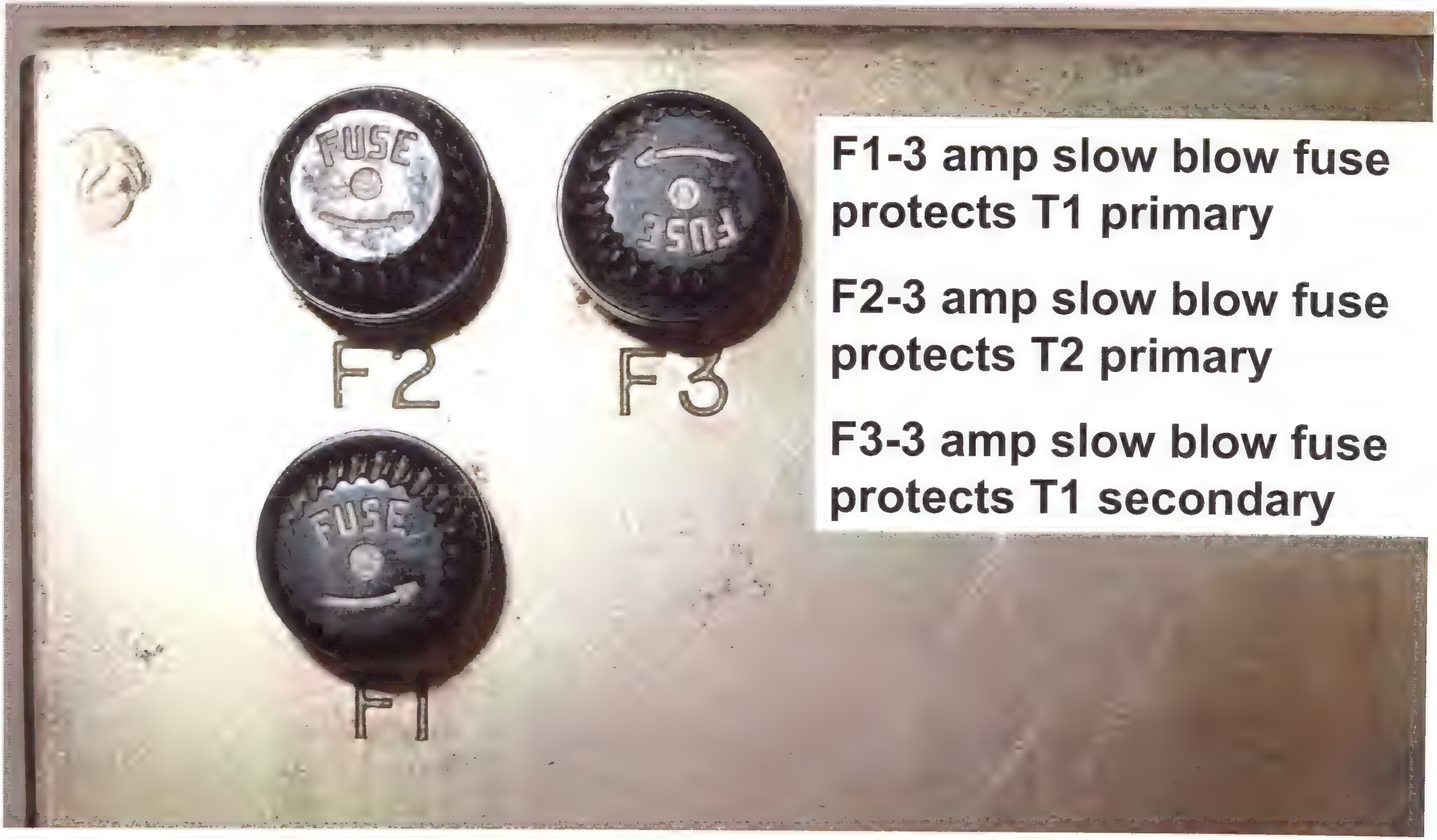
Converts current from AC to DC for the Mask lights and sparemaker lights

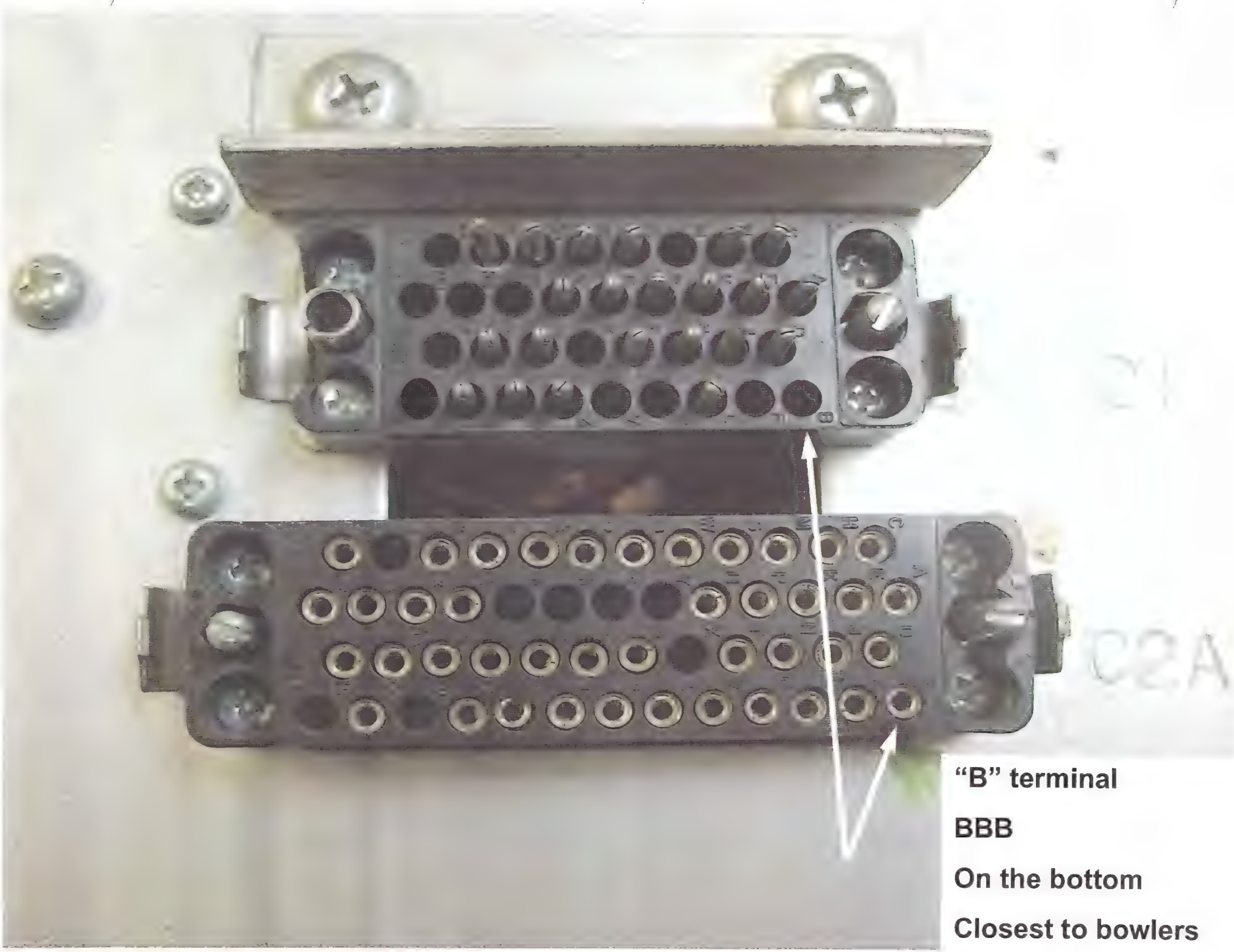




29

ss chassis components


FUSE
FUSE
FUSE
F2
F3
F1
F1-3 amp slow blow fuse
protects T1 primary
F2-3 amp slow blow fuse
protects T2 primary
F3-3 amp slow blow fuse
protects T1 secondary

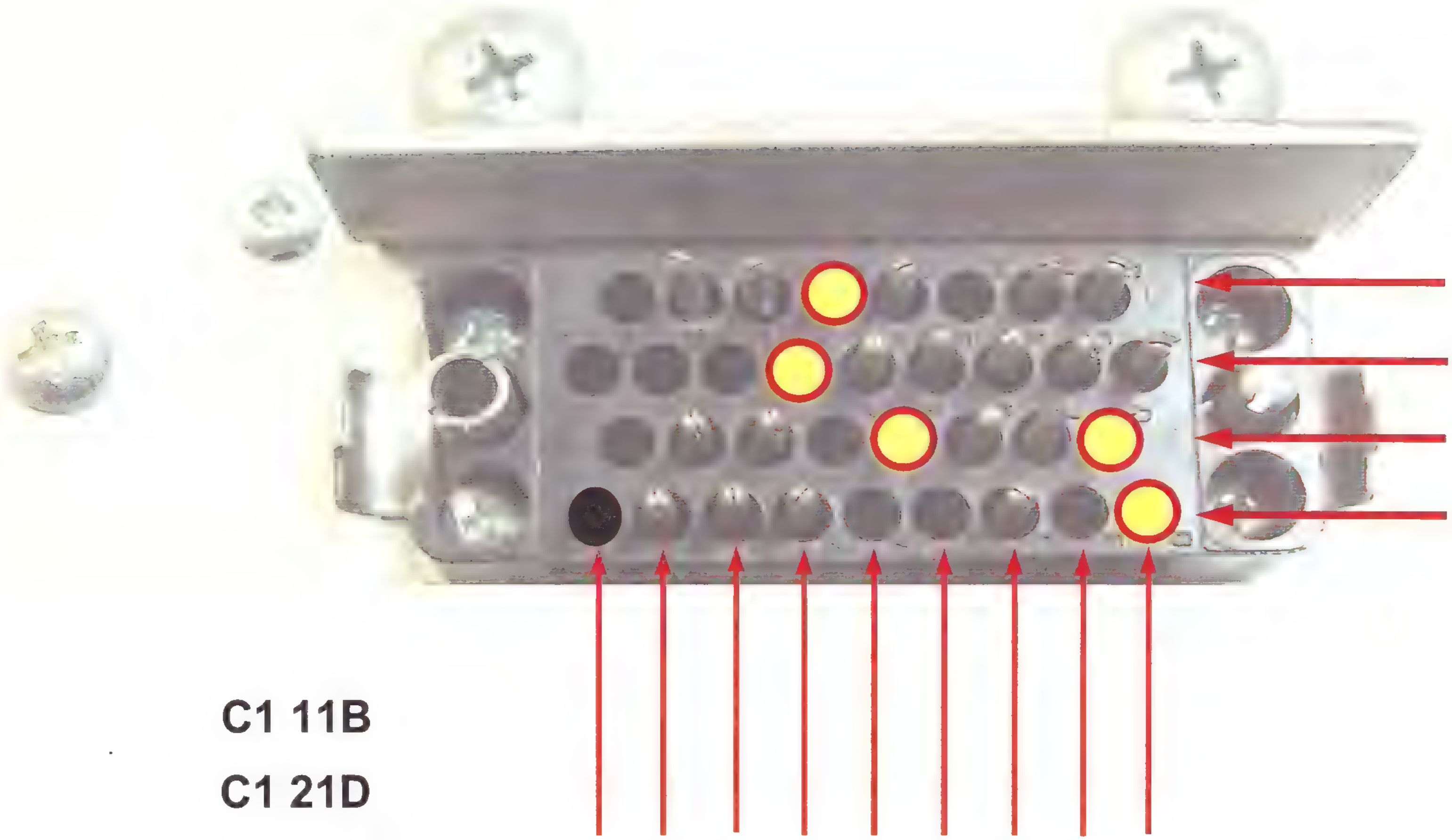


"B" terminal

BBB

On the bottom

Closest to bowlers



First number references the row starting at the bottom

Second number references the pin starting from right to left

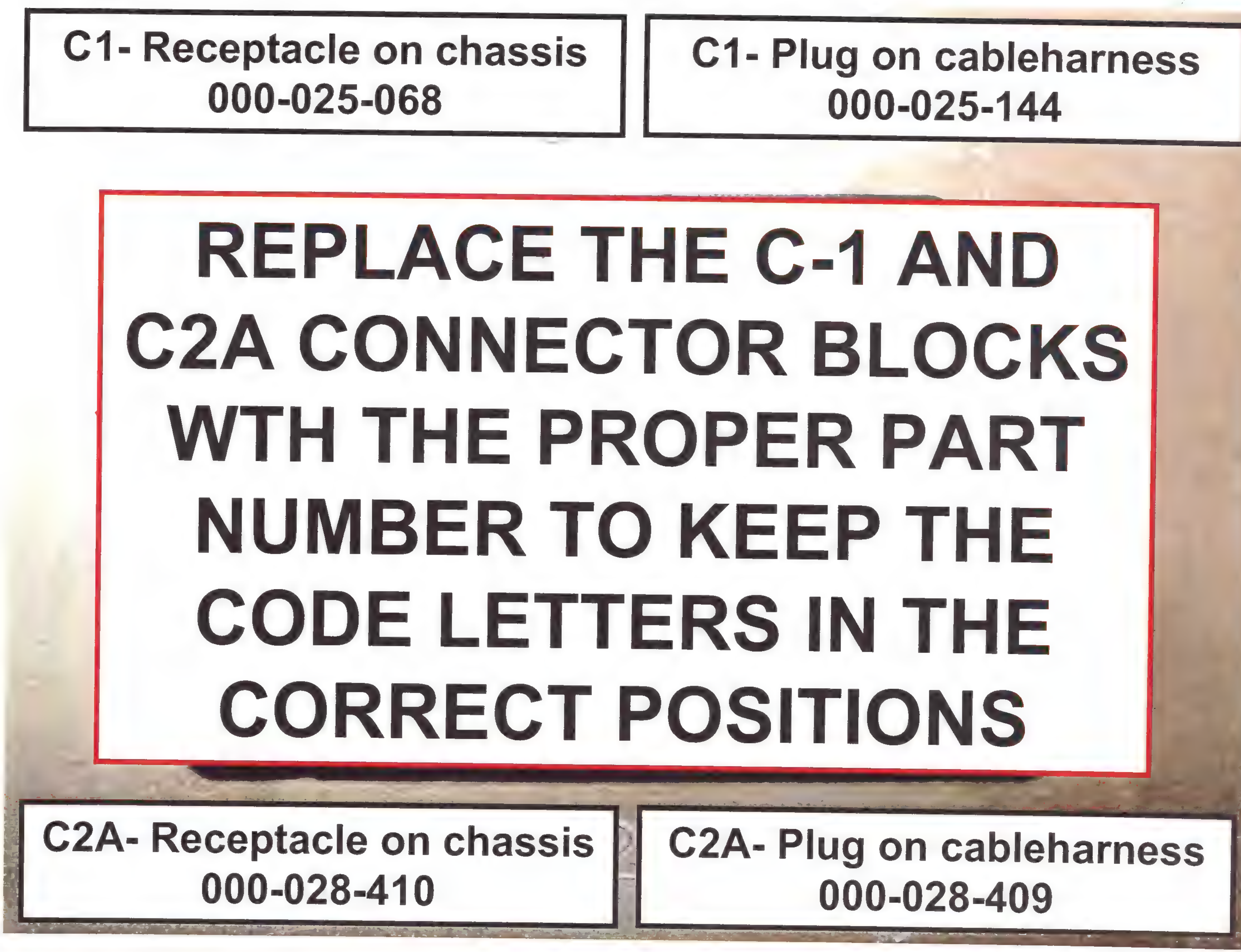
C1 11B

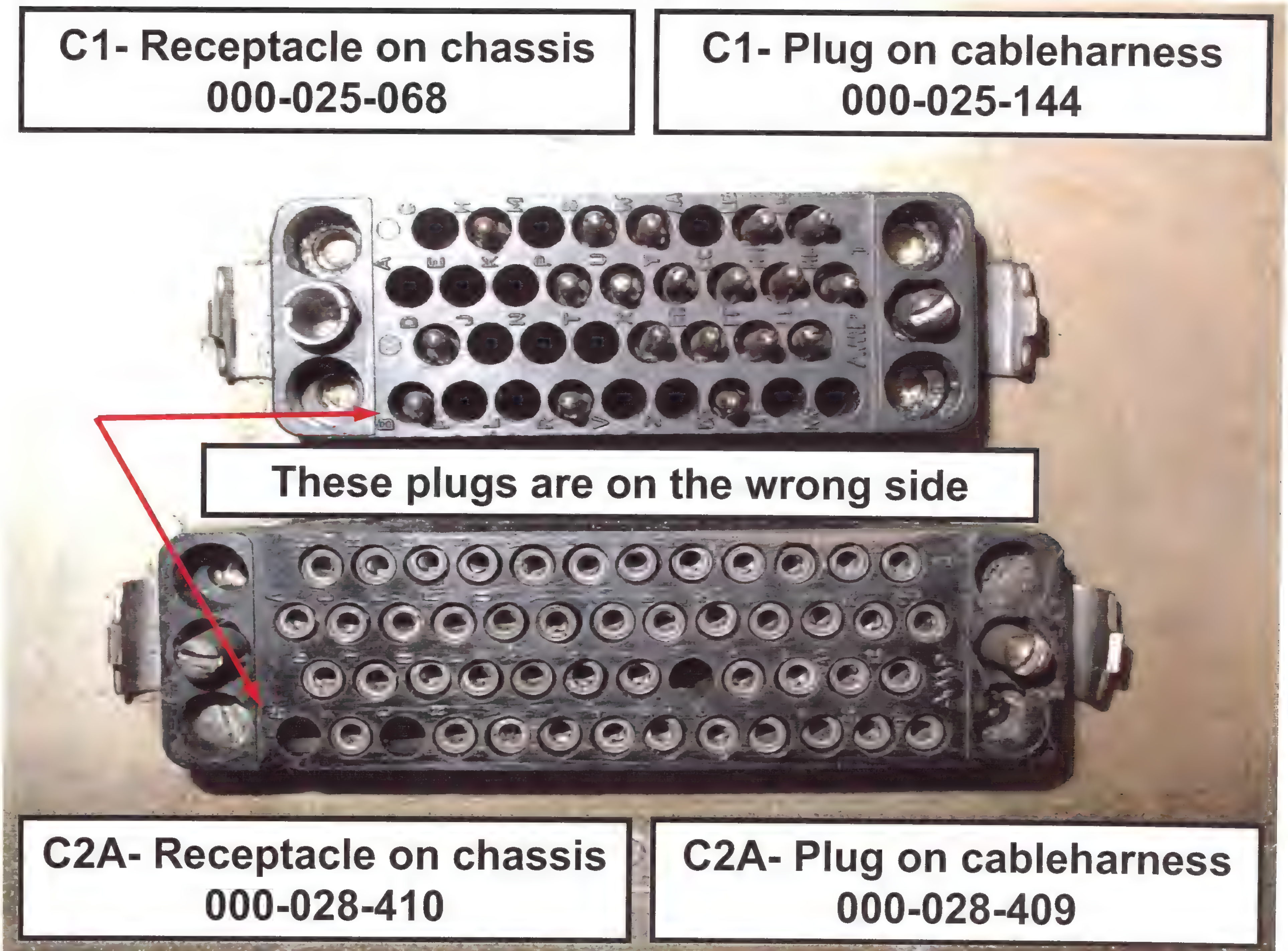
C1 21D

C1 24 T

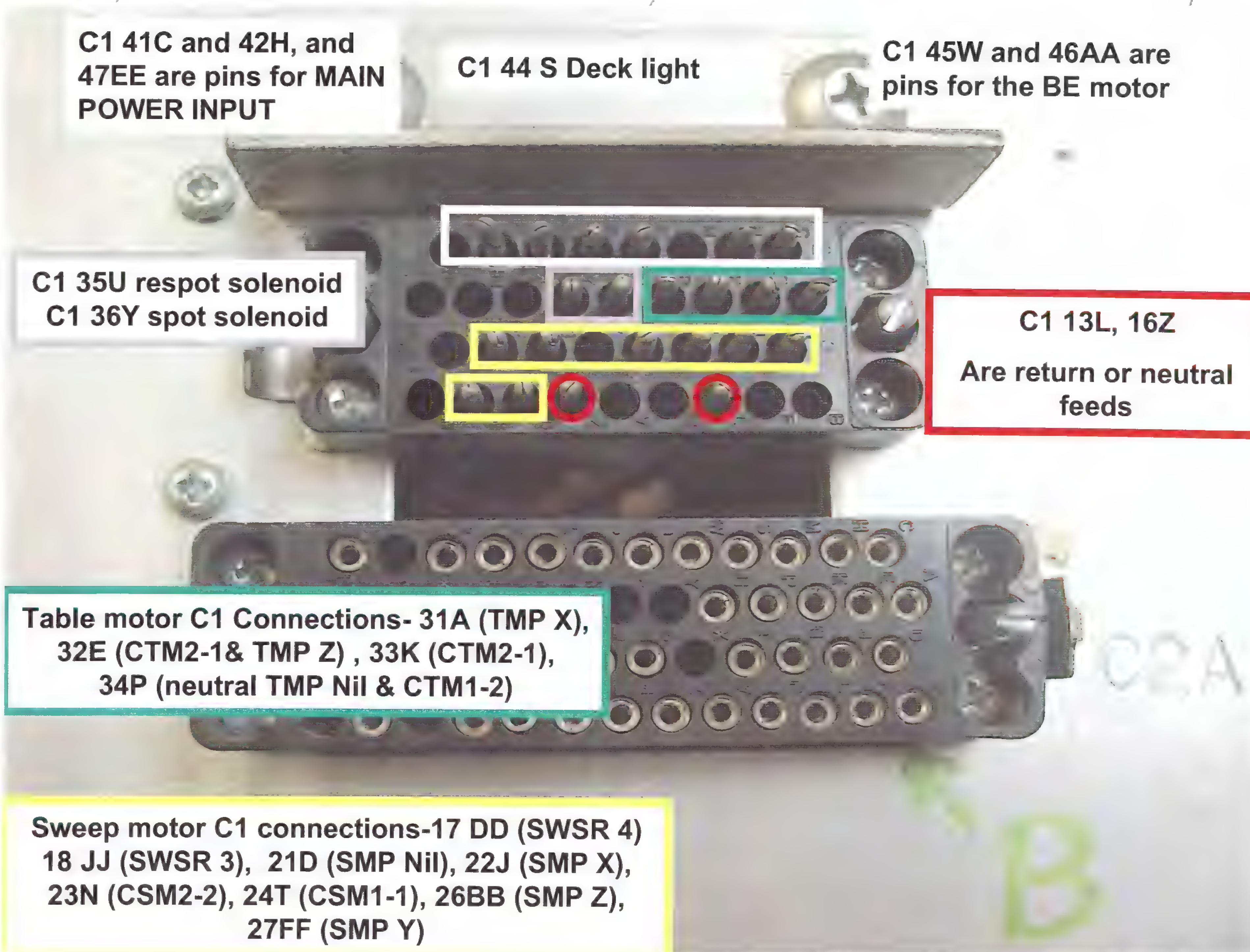
C1 36 Y

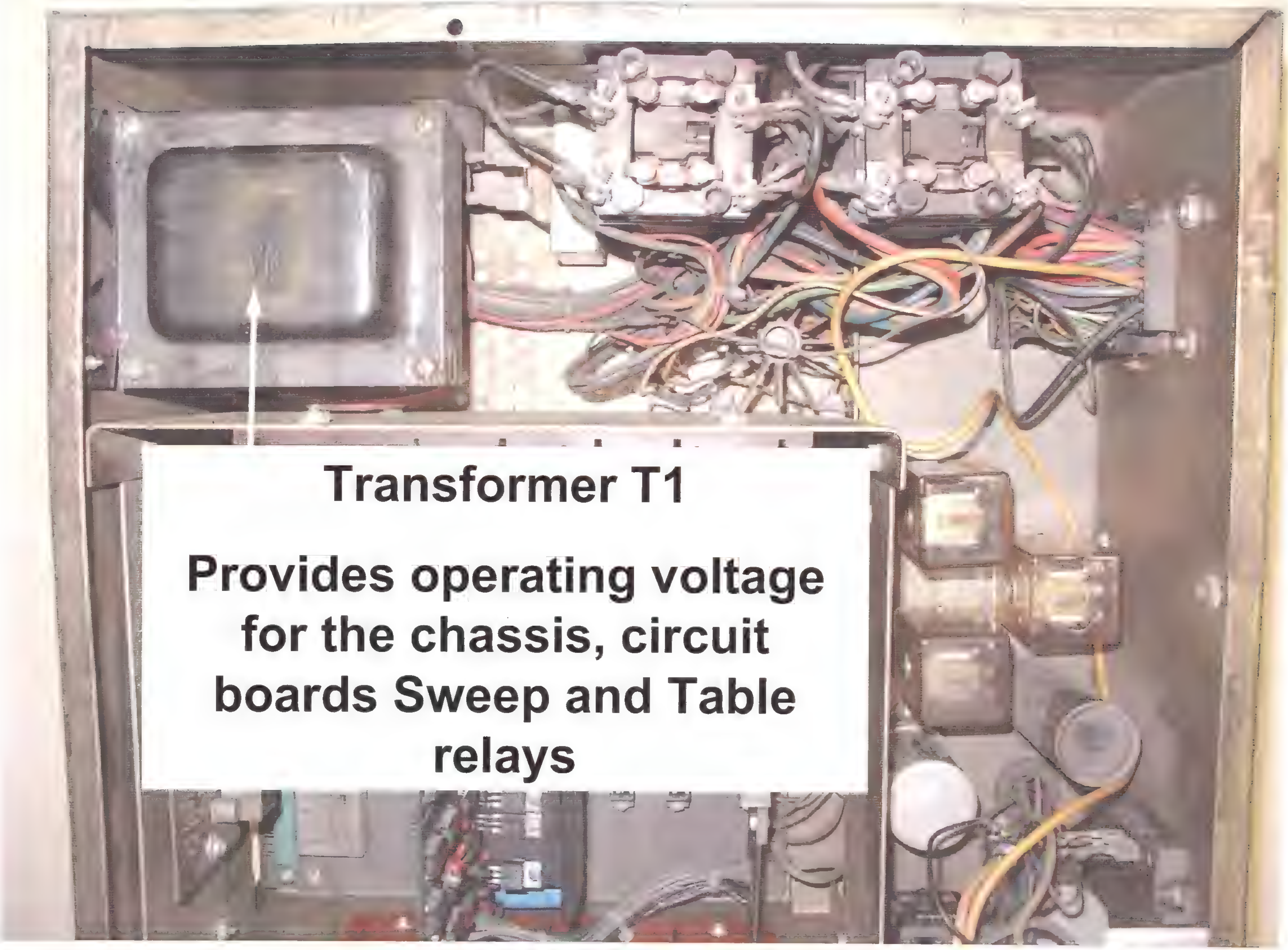
C1 45 W

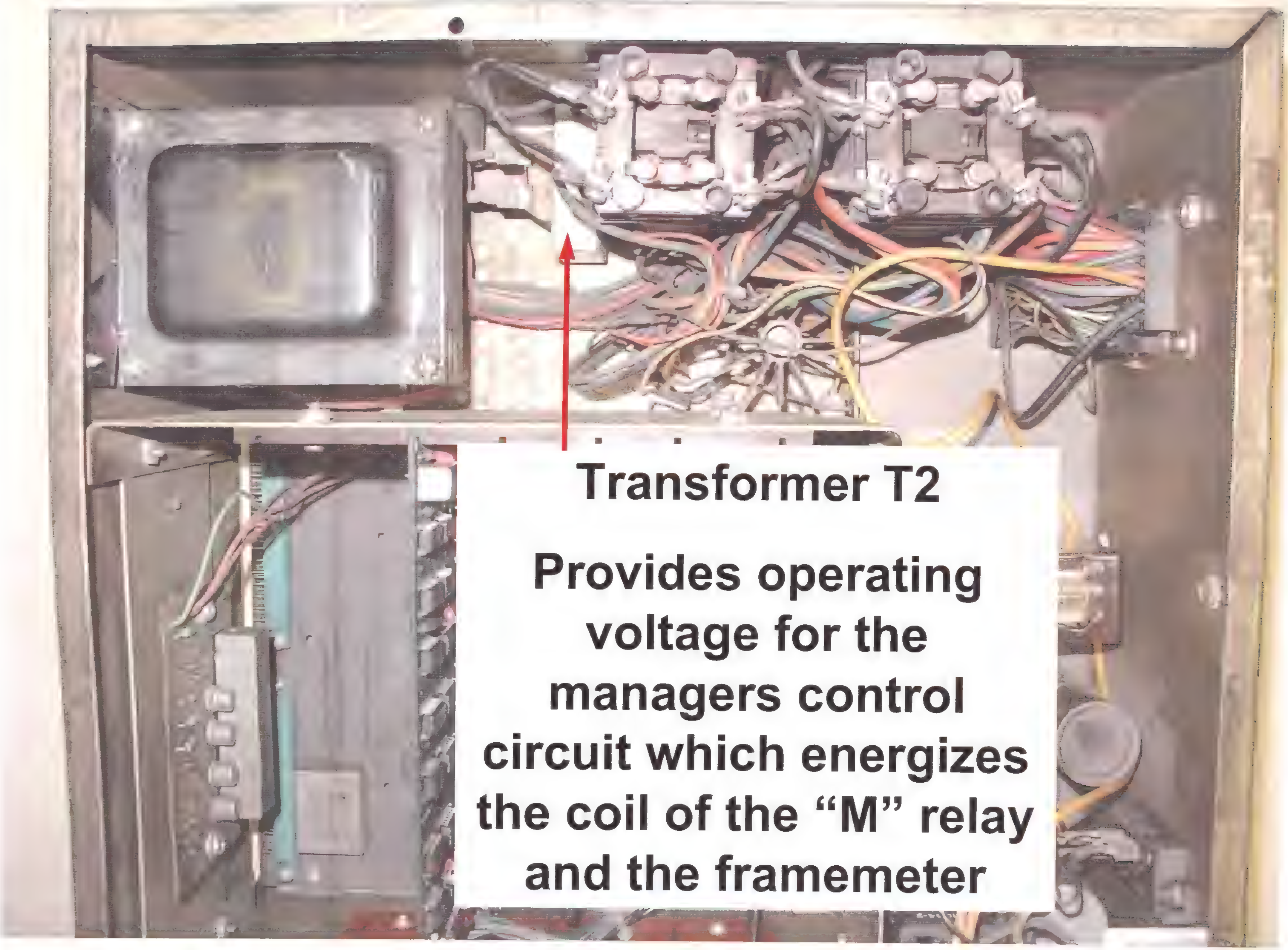

C1- Receptacle on chassis
000-025-068
C1- Plug on cableharness
000-025-144
REPLACE THE C-1 AND C2A CONNECTOR BLOCKS WTH THE PROPER PART NUMBER TO KEEP THE CODE LETTERS IN THE CORRECT POSITIONS
C2A- Receptacle on chassis
000-028-410
C2A- Plug on cableharness
000-028-409


C1- Receptacle on chassis
000-025-068
C1- Plug on cableharness
000-025-144
These plugs are on the wrong side
C2A- Receptacle on chassis
000-028-410
C2A- Plug on cableharness
000-028-409

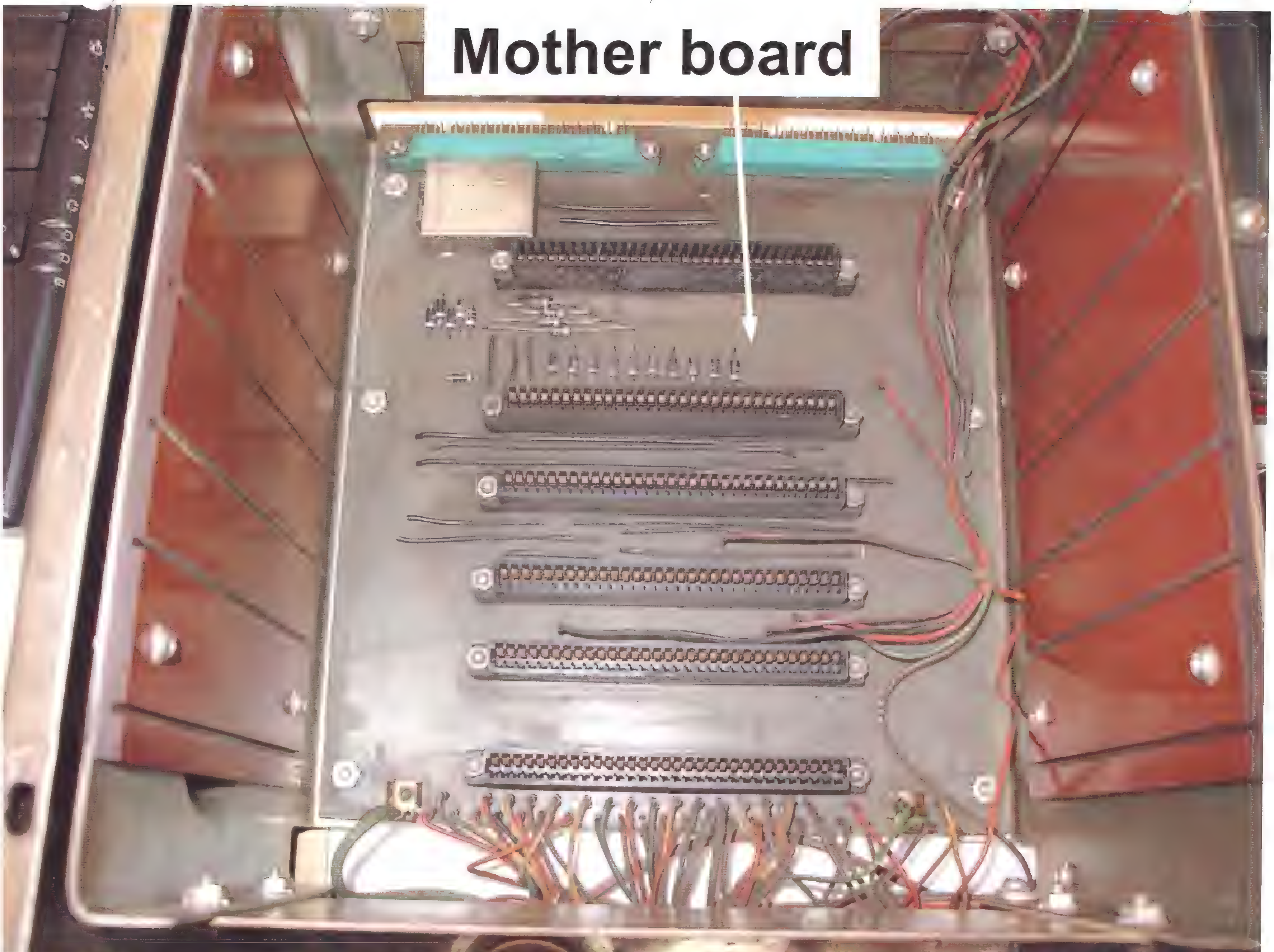
5

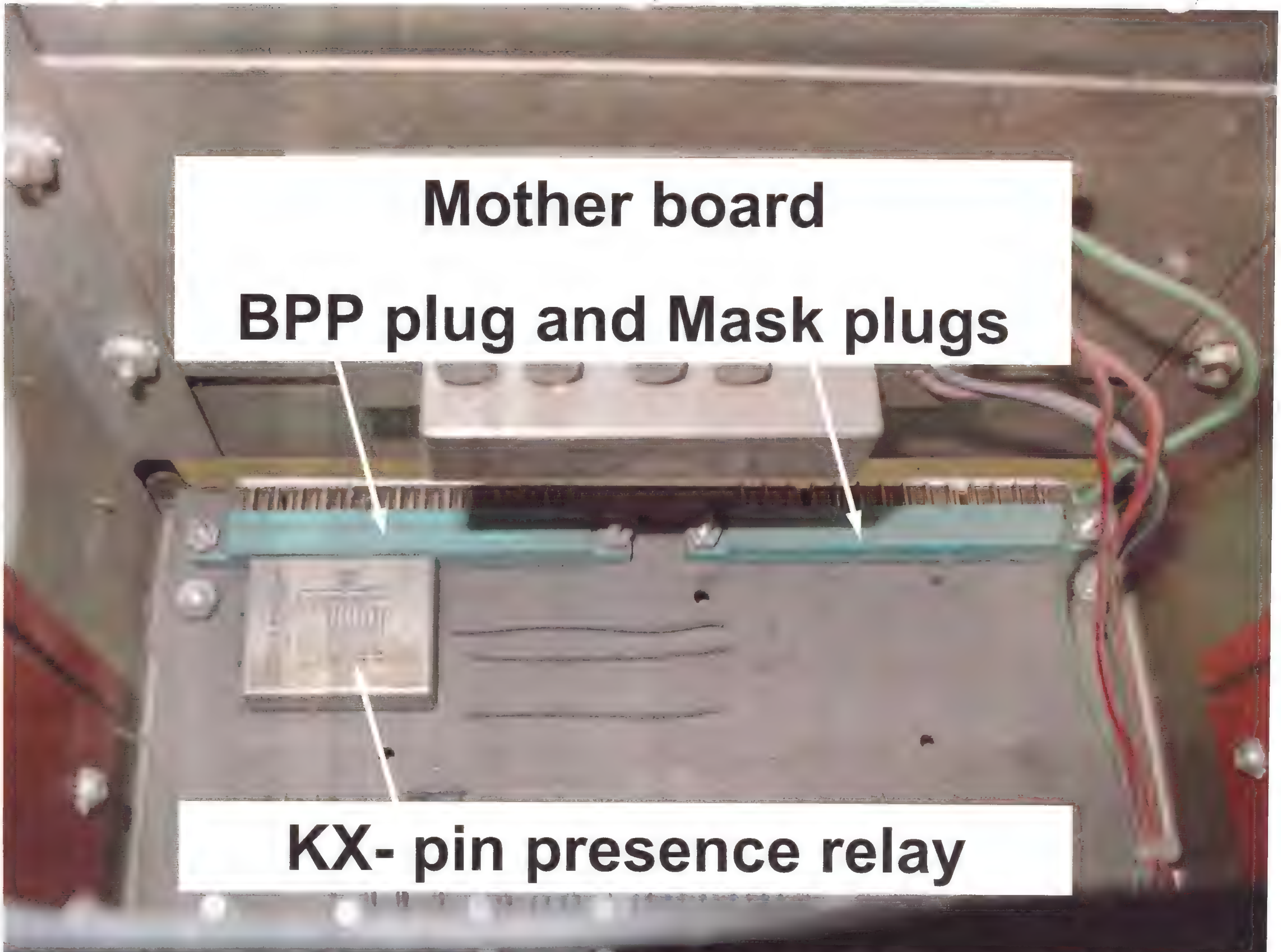

C1 41C and 42H, and 47EE are pins for MAIN POWER INPUT
C1 44 S Deck light
C1 45W and 46AA are pins for the BE motor
C1 35U respot solenoid
C1 36Y spot solenoid
C1 13L, 16Z
Are return or neutral feeds
Table motor C1 Connections- 31A (TMP X), 32E (CTM2-1& TMP Z) , 33K (CTM2-1), 34P (neutral TMP Nil & CTM1-2)
Sweep motor C1 connections-17 DD (SWSR 4) 18 JJ (SWSR 3), 21D (SMP Nil), 22J (SMP X), 23N (CSM2-2), 24T (CSM1-1), 26BB (SMP Z), 27FF (SMP Y)
C2A
B


Transformer T1
Provides operating voltage for the chassis, circuit boards Sweep and Table relays

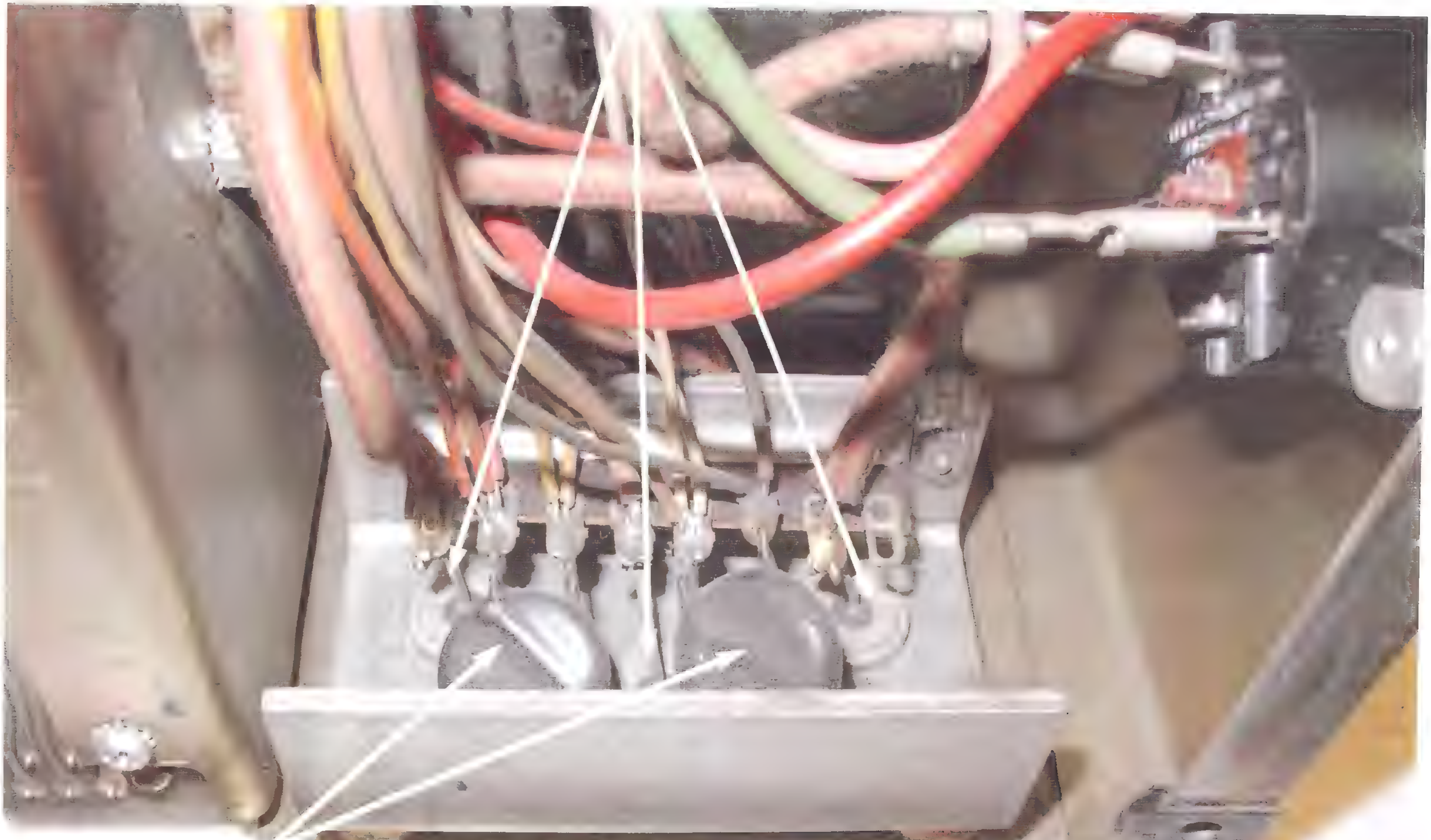

Transformer T2
Provides operating voltage for the managers control circuit which energizes the coil of the "M" relay and the framemeter

8


Mother board


Mother board
BPP plug and Mask plugs
KX- pin presence relay

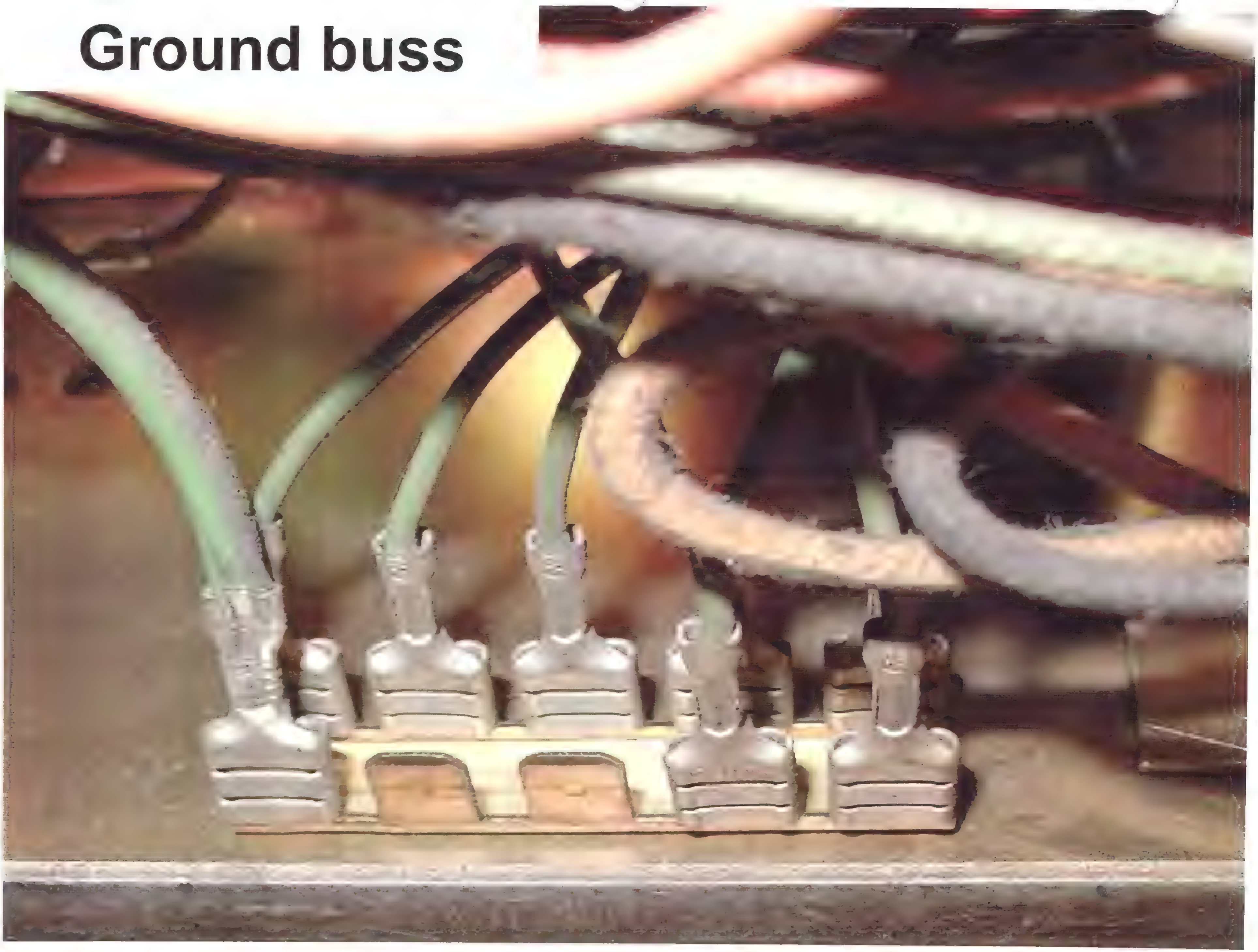
Diodes that convert AC to DC for mask lights

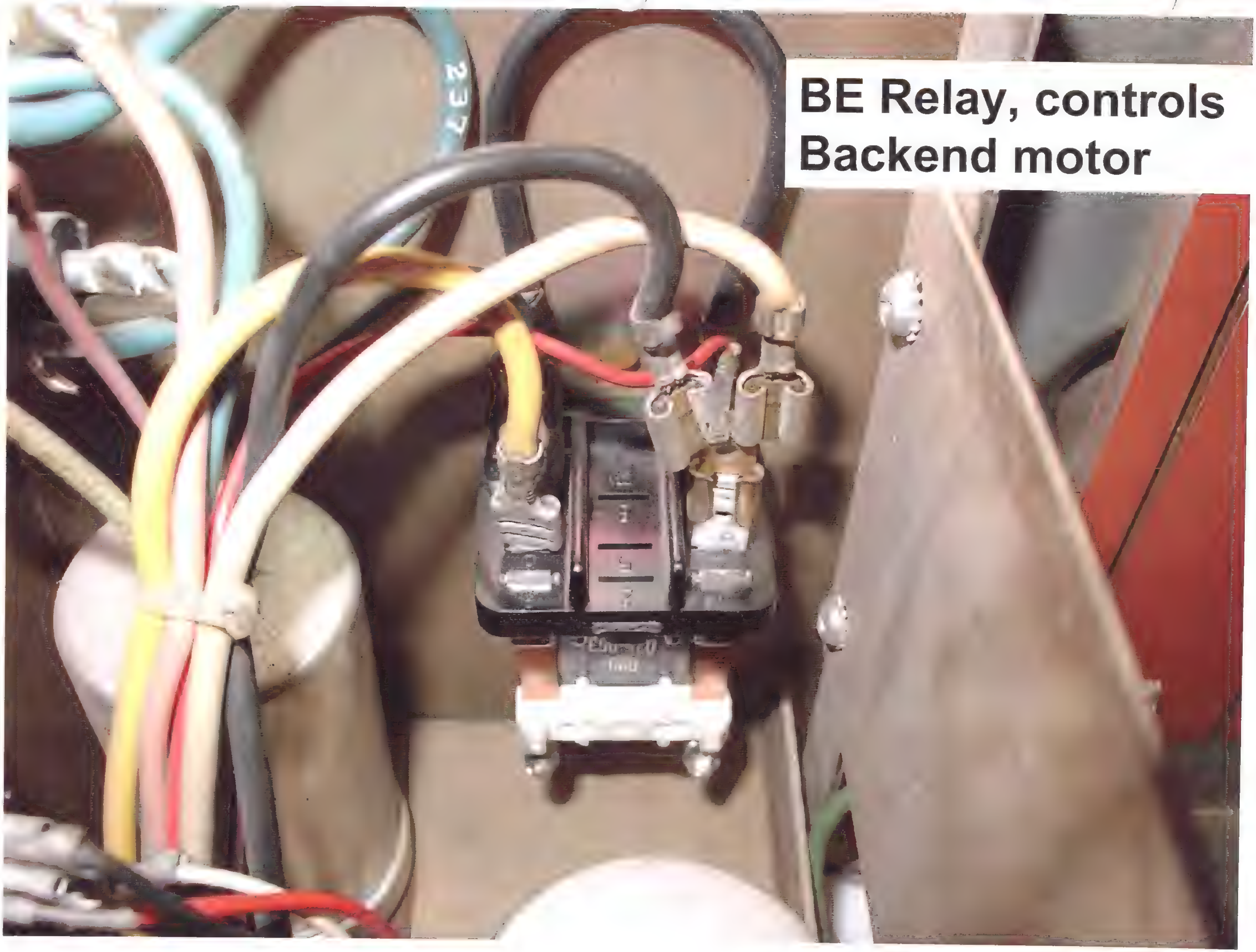


Varistors to protect the circuit boards from the inductive kickback voltage produced when the S and T relays release

OLL, “Klixon” protection for the masking unit lamps

Ground buss

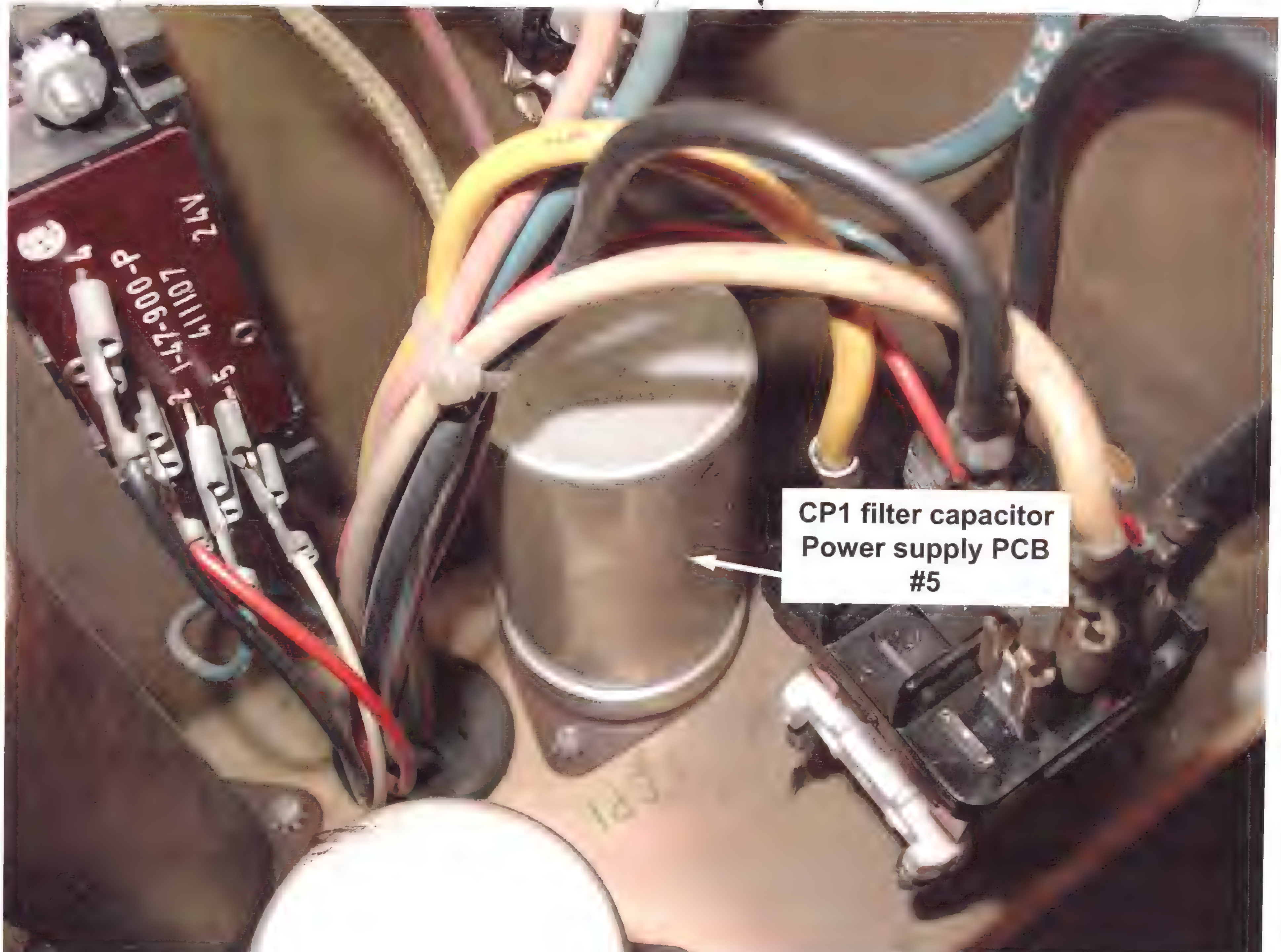


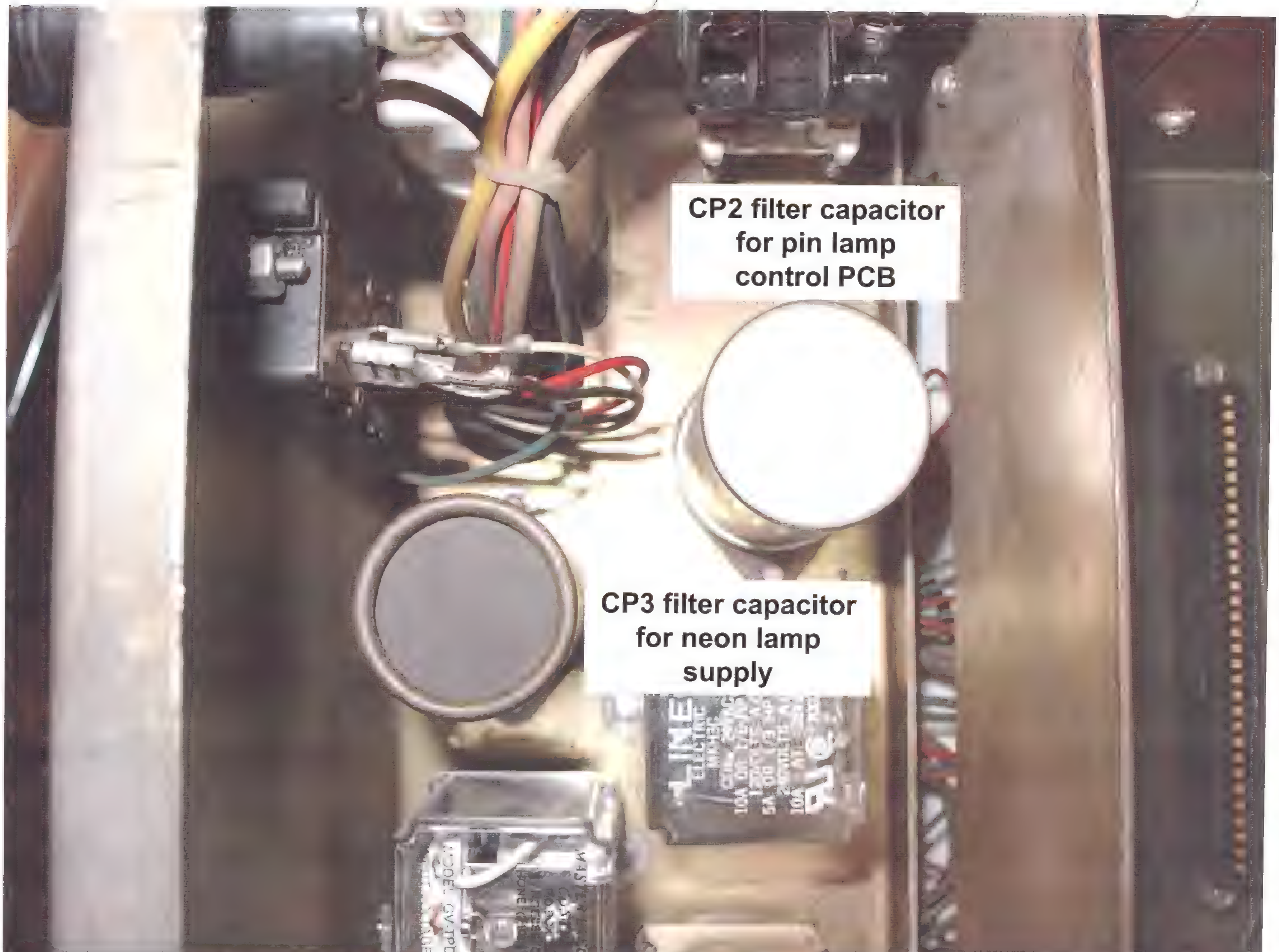

BE Relay, controls
Backend motor
237

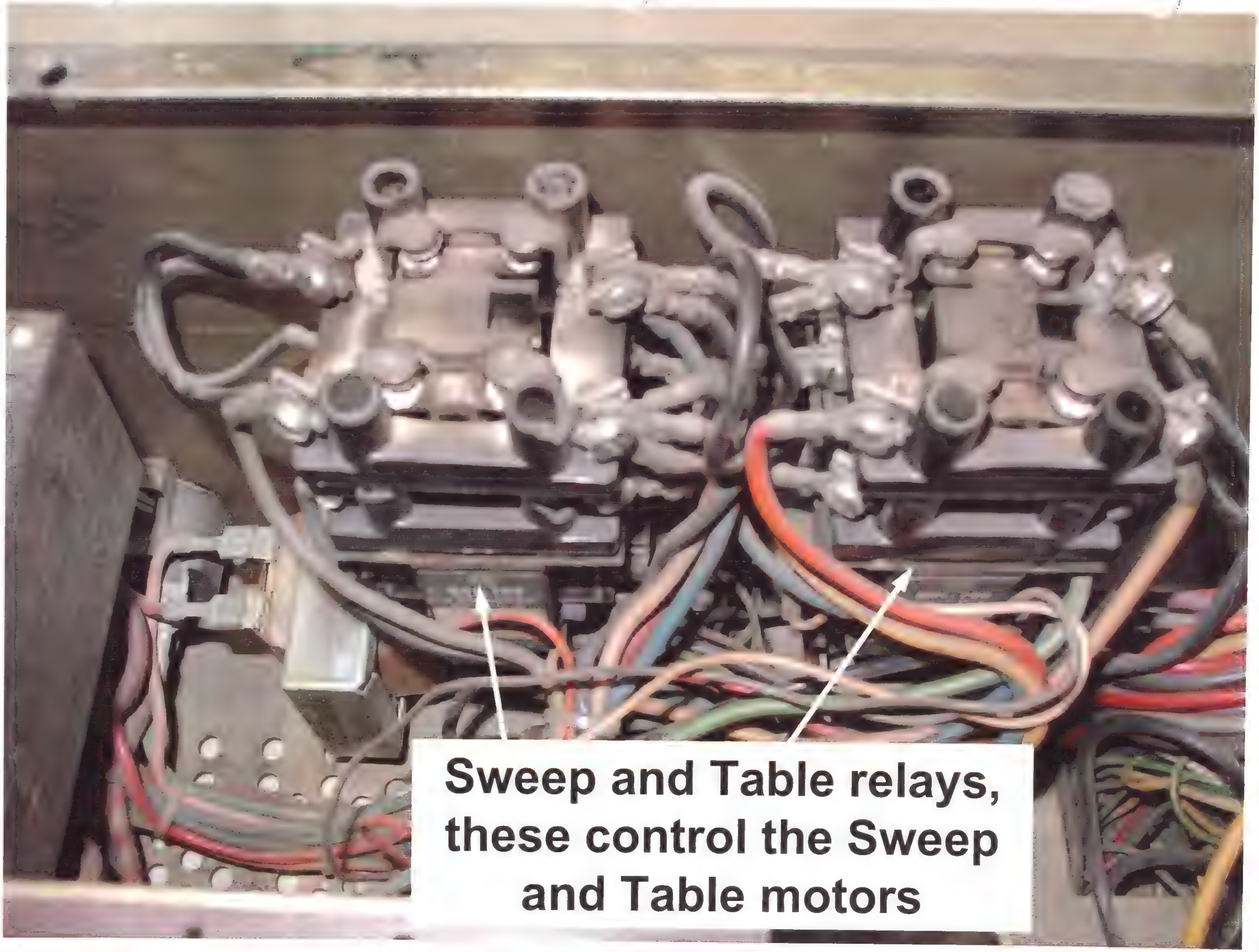
H Thermal time delay relay, controls M2 relay power off

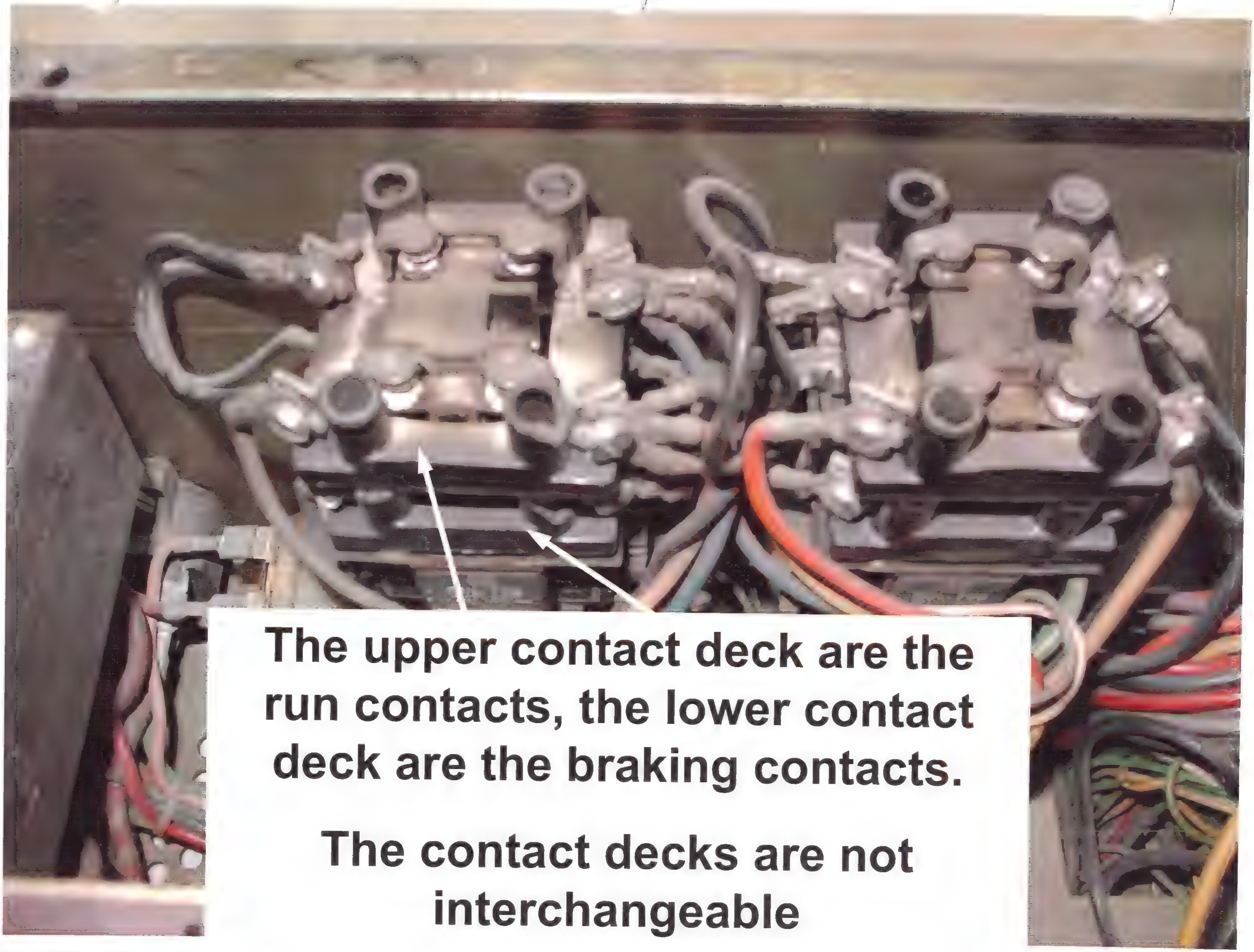

M2-Time delay
for BE motor
M2
MASTER ELECTRONIC
CONTROLS
P.O. BOX 25095
LOS ANGELES, CA 90025
PHONE. (310) 452-1336
MODEL GV-TPDT-12D
M-Managers
control relay
SP-Spot relay

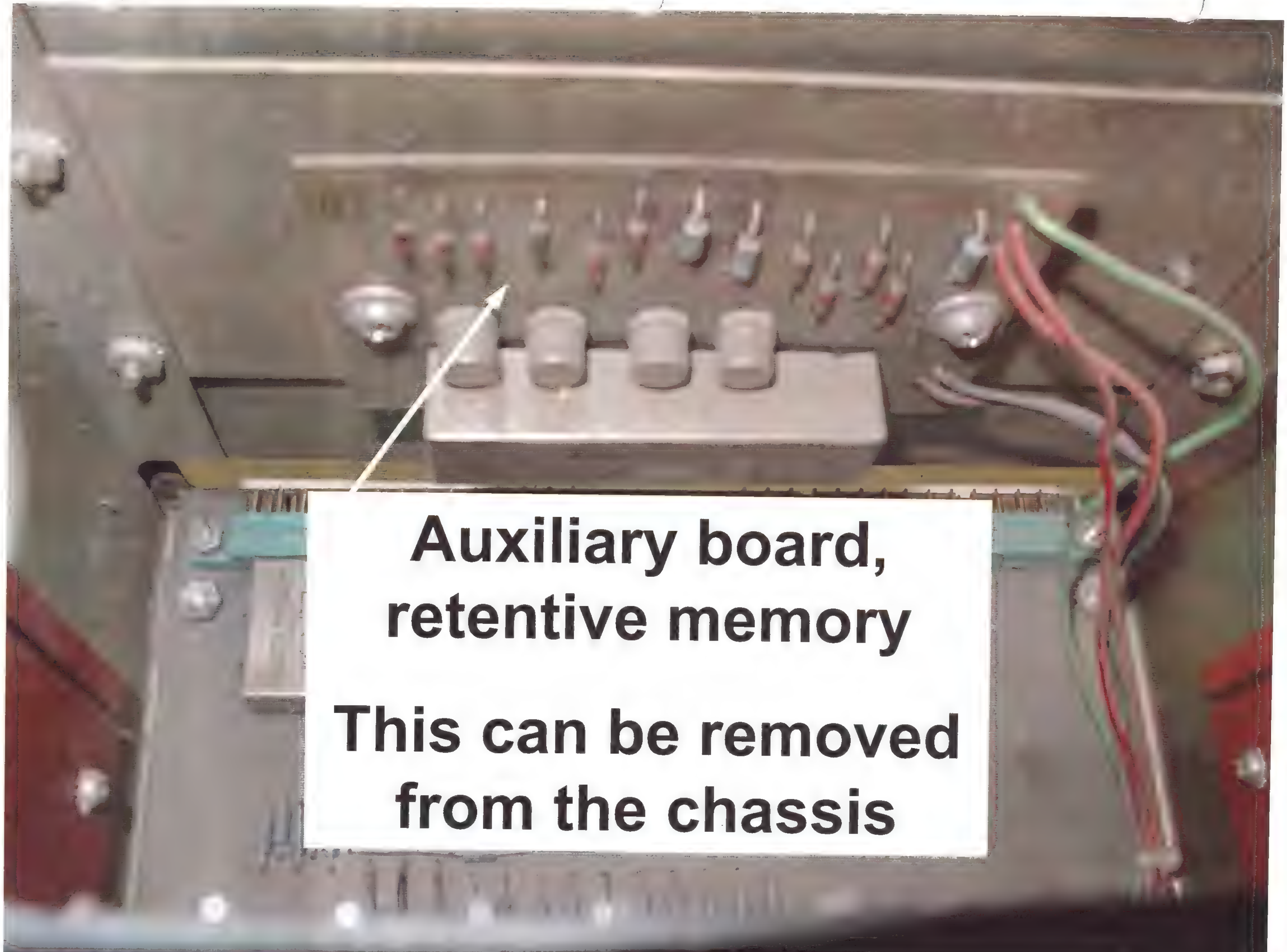
16


CP1 filter capacitor
Power supply PCB
#5
24V
411107
1-47-900-P
CP1


CP2 filter capacitor for pin lamp control PCB
CP3 filter capacitor for neon lamp supply


Sweep and Table relays,
these control the Sweep
and Table motors


The upper contact deck are the run contacts, the lower contact deck are the braking contacts.
The contact decks are not interchangeable


Auxiliary board,
retentive memory
This can be removed
from the chassis

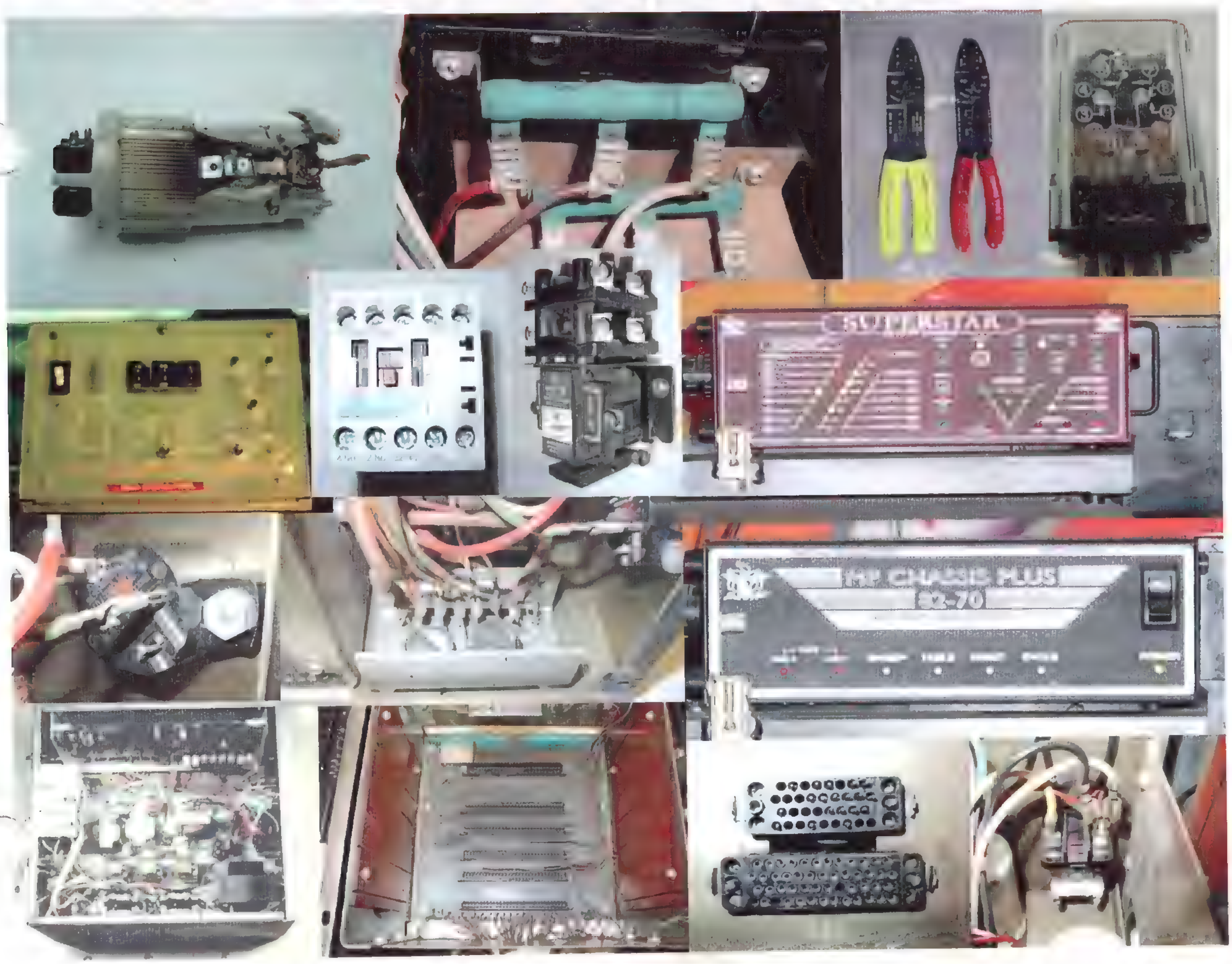
Pin lamp triac, this can be removed from the chassis

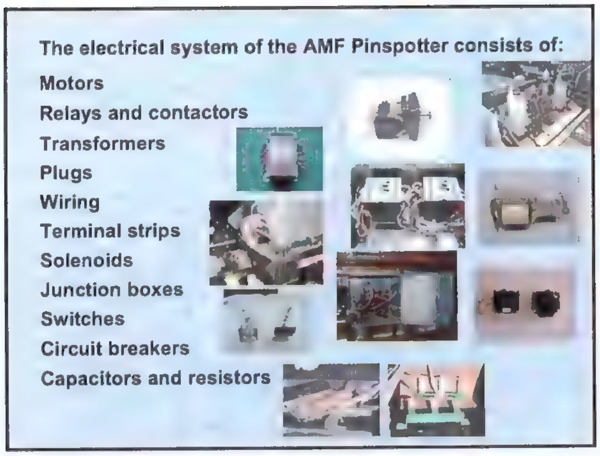
Electrical

AMF

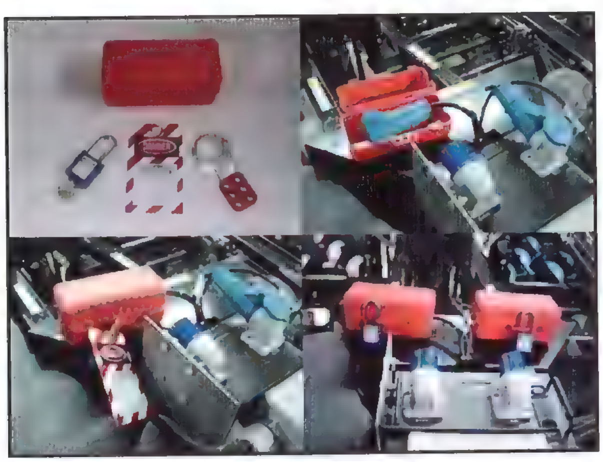
BOWLING TECH

AMF 82-70 ELECTRICAL



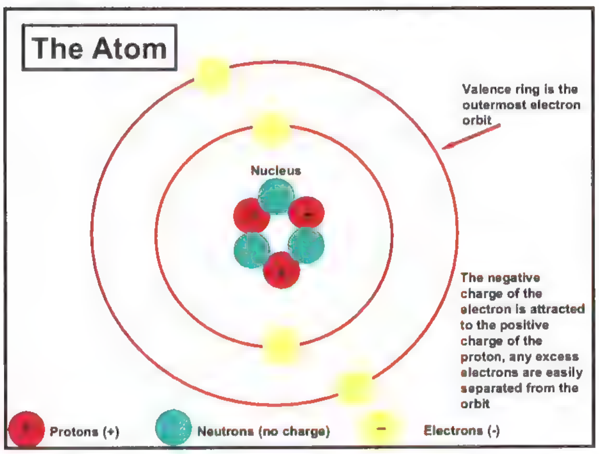

The electrical system of the AMF Pinspotter consists of:
Motors
Relays and contactors
Transformers
Plugs
Wiring
Terminal strips
Solenoids
Junction boxes
Switches
Circuit breakers
Capacitors and resistors


REMOVE THE POWER PLUG
LOCK OUT THE PLUG TO PREVENT INJURIES



What is electricity?

Electricity is the movement of free electrons from one atom to another atom within a conductor



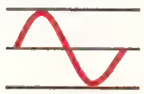
Electron flow from atom to atom or "Current" is similar to balls in a tube.

As you push one in the end all that are in the tube move over.

Types of current

AC or alternating current

Alternating current changes directions 60 times per second



Types of current

DC current is converted or produced by rectification

Positive +

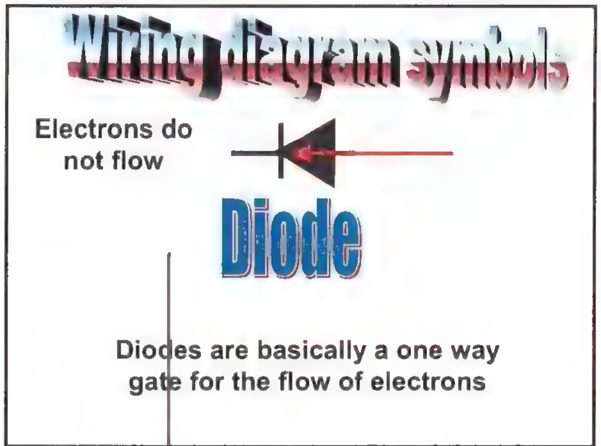
Negative -

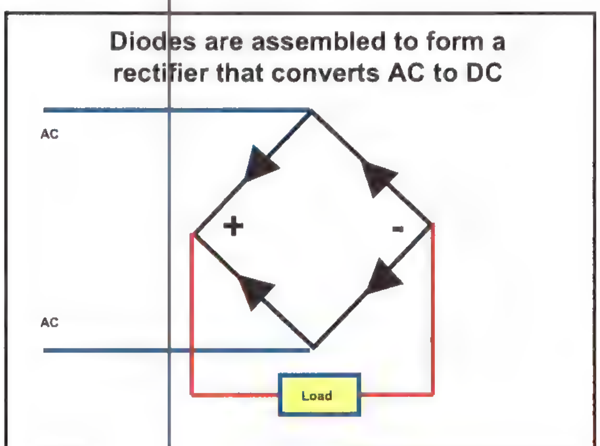
Wiring diagram symbols

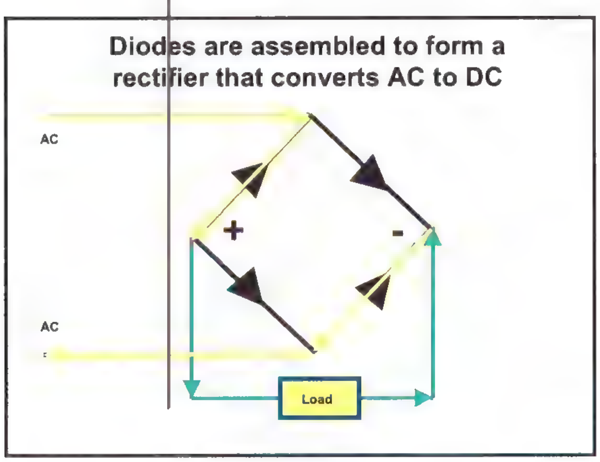
Electrons flow

Diode

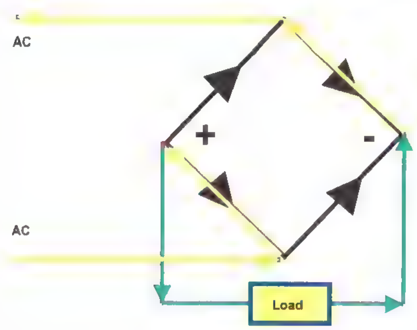
Diodes are basically a one way gate for the flow of electrons


Wiring diagram symbols
Electrons do not flow
Diode
Diodes are basically a one way gate for the flow of electrons


Diodes are assembled to form a rectifier that converts AC to DC
AC
+
-
AC
Load


Diodes are assembled to form a rectifier that converts AC to DC
AC
+
-
AC
Load

Diodes are assembled to form a rectifier that converts AC to DC



Voltage:

A measurement of electrical pressure or potential

Current: The flow of electrons in a circuit.

Amperage: A measurement of current flow

Conductor:

A component within an electrical circuit that carries the electrical current flow. (wire)

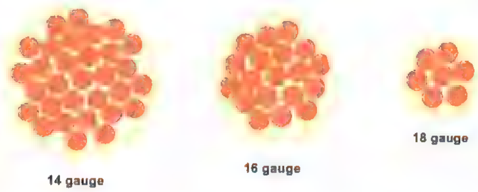
AWG:

American wire gauge a system used to determine wire size, the larger the number the smaller the wire

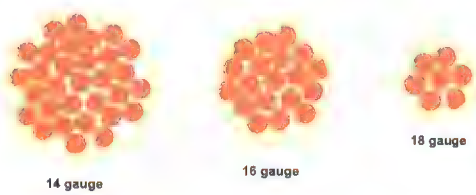
Continuity:

To maintain an unbroken link or connection

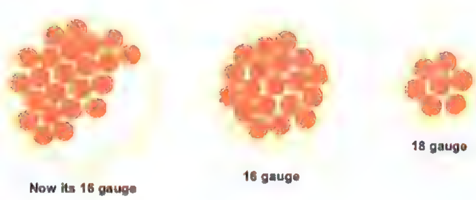
Practically speaking "A good piece of wire"



A larger wire, has a greater capacity to carry an electrical current



Care must be taken when stripping a wire so you do not remove strands of wire thereby reducing its cross sectional area.



A conductor is only as strong as its weakest link

Load:

A component within an electrical circuit that uses the electricity and produces work, lights, motors, solenoids, etc…

Resistance: The opposition to the flow of electrical current in a circuit, all loads in an electrical circuit have an amount of resistance.

Ohms: A measurement of resistance to electron flow

Voltage drop:

Voltage in a conductor will decrease as the length of the conductor increases, the longer the conductor the more resistance it has.

Resistance and temperature are directly proportional.

As the temperature of a conductor increases, the resistance of the conductor increases. As resistance increases so will the temperature of the conductor

Current flowing within a conductor will generate a magnetic field around the conductor.

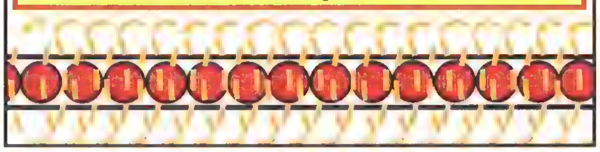
A moving magnetic field around a conductor will generate an electrical current.

AC Current flowing within a conductor will generate a moving magnetic field around the conductor.

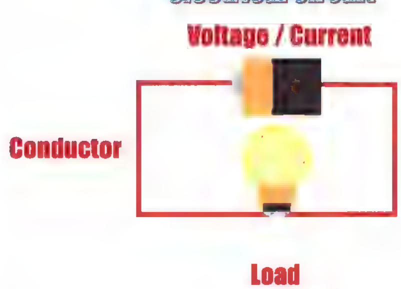
The inverse is true-

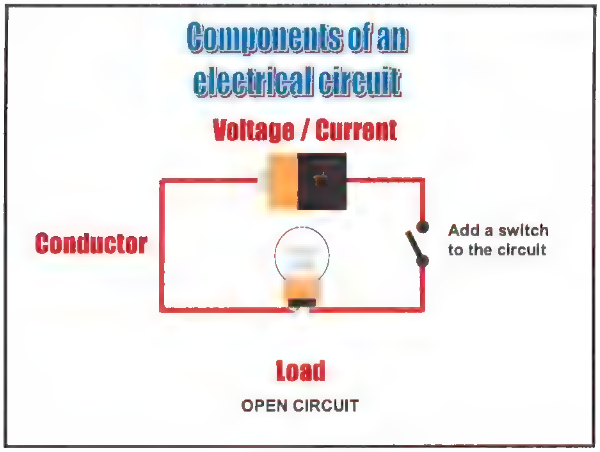
A moving magnetic field around a conductor will generate an electrical current.

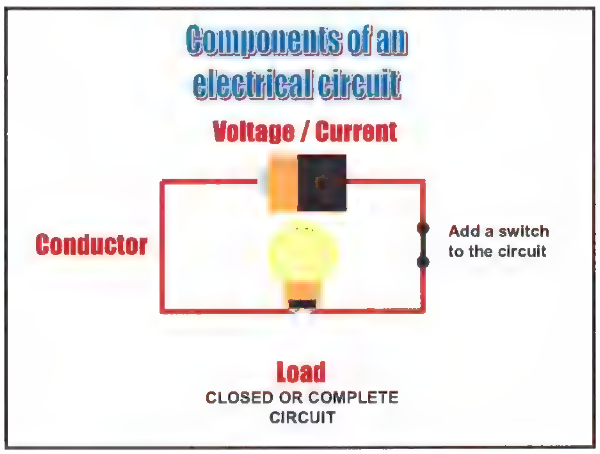
DC Current flowing within a conductor will also generate a magnetic field around the conductor, but the field only moves (collapses) when the current flow stops.



Components of an electrical circuit



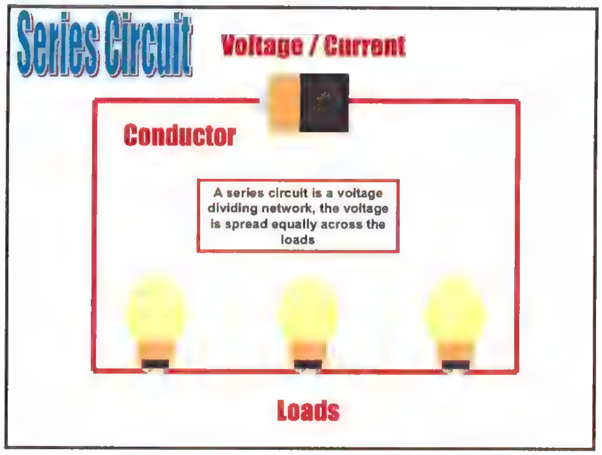


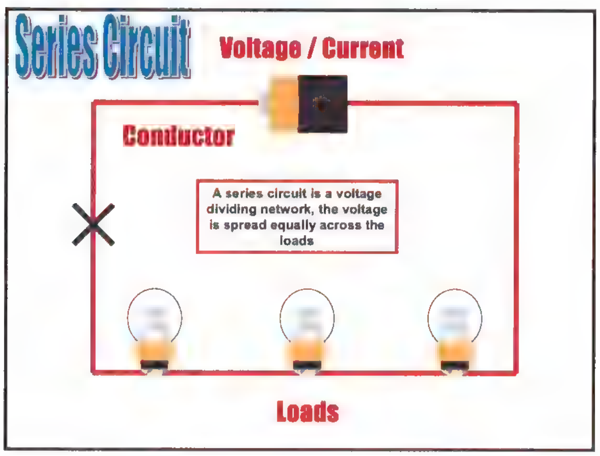


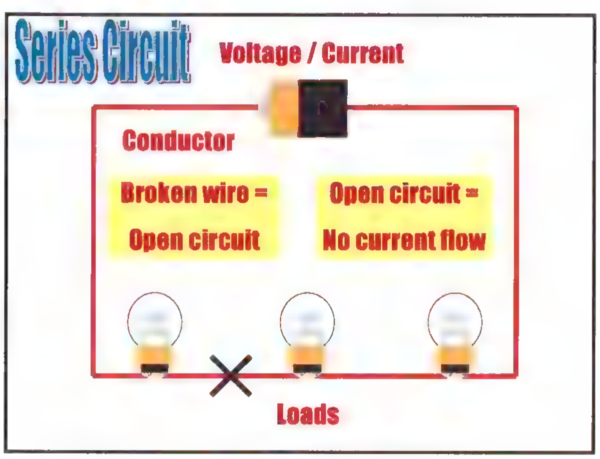
Electrical circuits

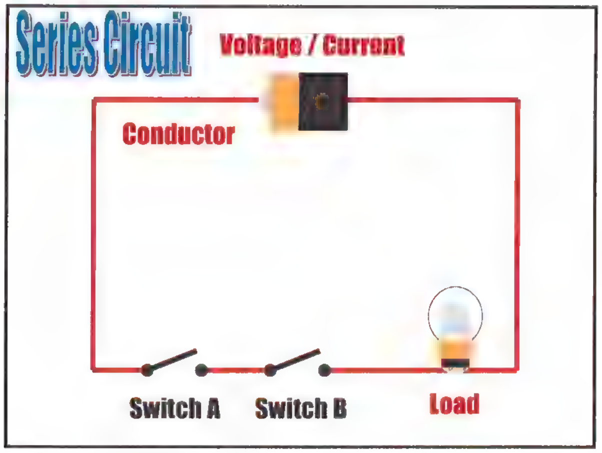
Series

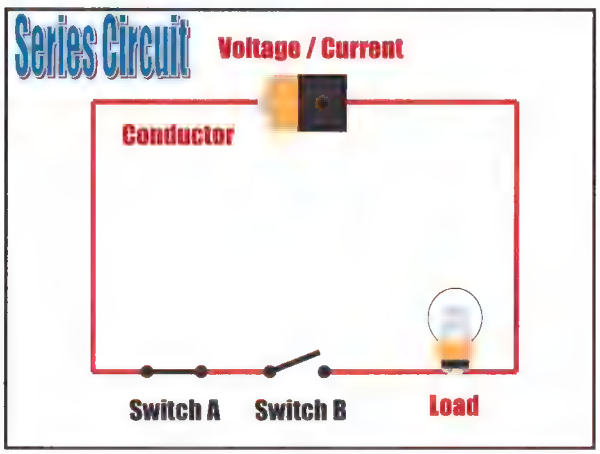
Parrallel

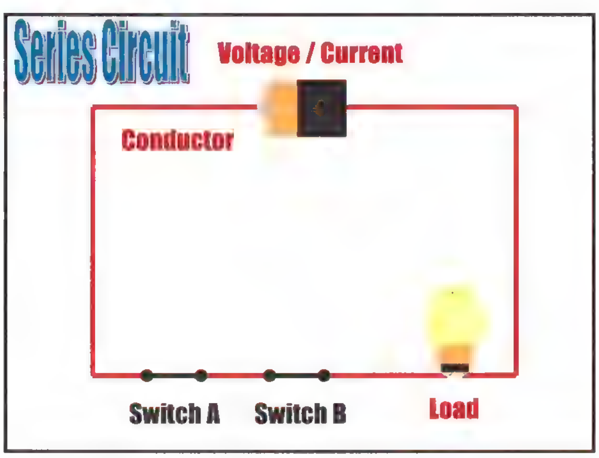

Series Circuit
Voltage / Current
Conductor
A series circuit is a voltage dividing network, the voltage is spread equally across the loads
Loads

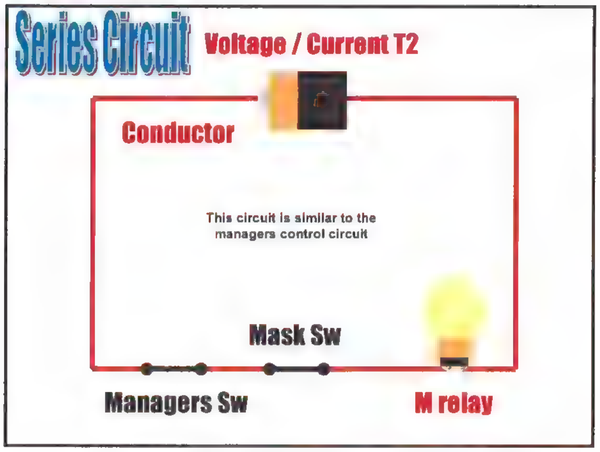

Series Circuit
Voltage / Current
Conductor
A series circuit is a voltage dividing network, the voltage is spread equally across the loads
Loads

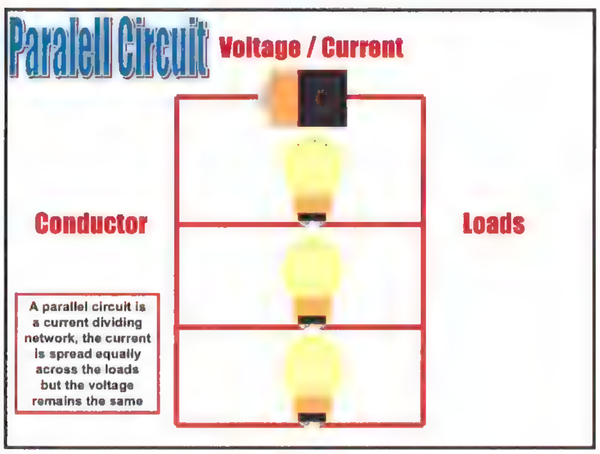

Series Circuit
Voltage / Current
Conductor
Broken wire =
Open circuit
Open circuit =
No current flow
Loads

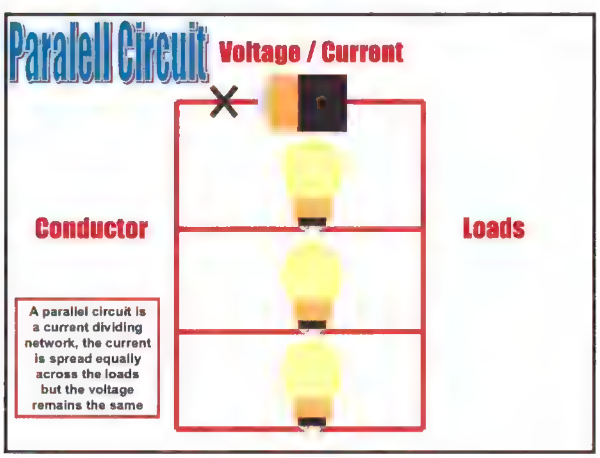

Series Circuit
Voltage / Current
Conductor
Switch A
Switch B
Load

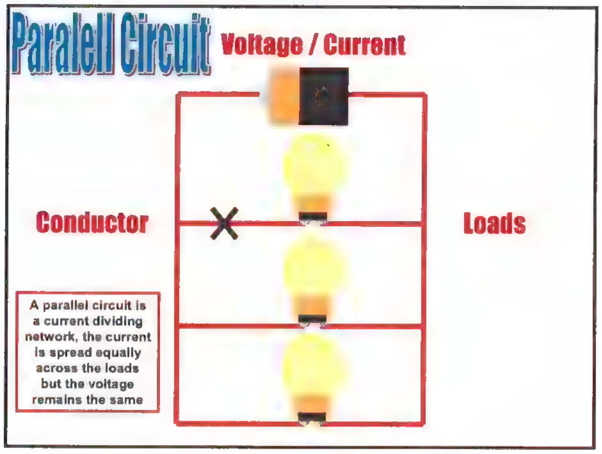

Series Circuit
Voltage / Current
Conductor
Switch A
Switch B
Load

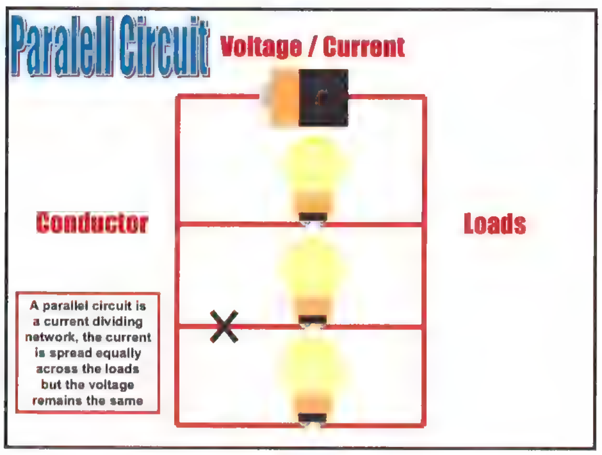

Series Circuit
Voltage / Current
Conductor
Switch A
Switch B
Load

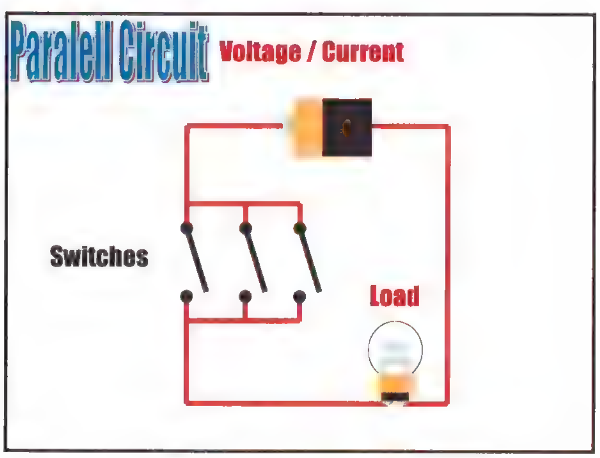

Series Circuit
Voltage / Current T2
Conductor
This circuit is similar to the managers control circuit
Mask Sw
Managers Sw
M relay


Paralell Circuit
Voltage / Current
Conductor
Loads
A parallel circuit is a current dividing network, the current is spread equally across the loads but the voltage remains the same

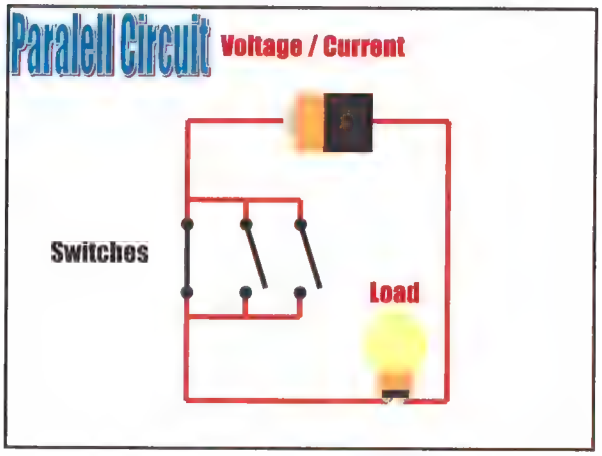

Paralell Circuit
Voltage / Current
Conductor
Loads
A parallel circuit is a current dividing network, the current is spread equally across the loads but the voltage remains the same

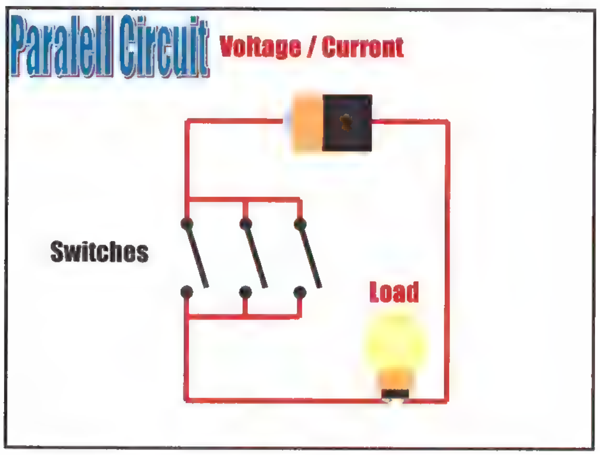


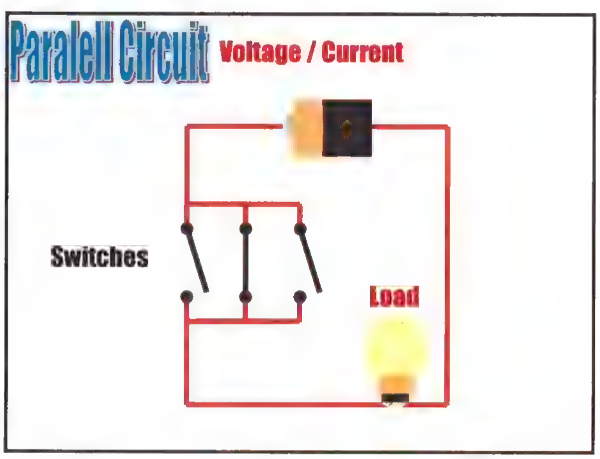


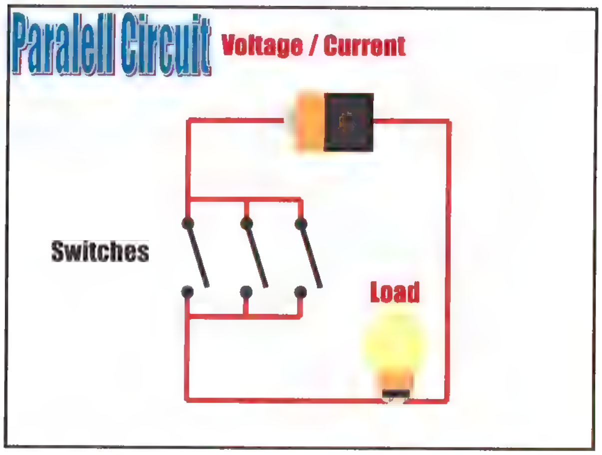


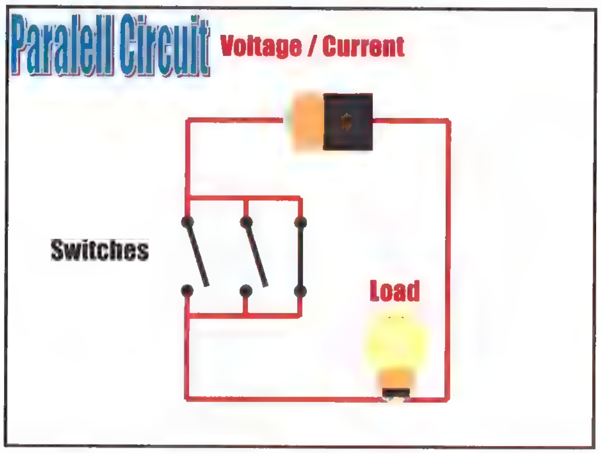
Cycle Circuit 12TH, SS, PBC

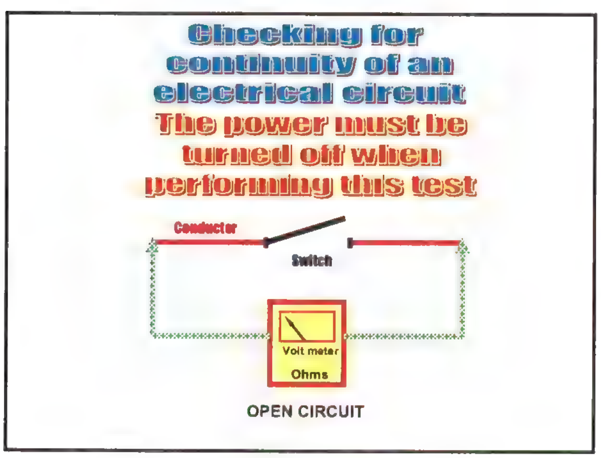

Paralell Circuit
Voltage / Current
Switches
Load


Paralell Circuit
Voltage / Current
Switches
Load

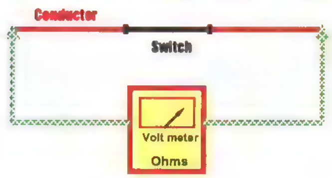

Paralell Circuit
Voltage / Current
Switches
Load


Paralell Circuit
Voltage / Current
Switches
Load


Paralell Circuit
Voltage / Current
Switches
Load

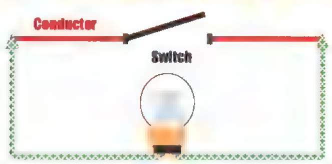

Checking for continuity of an electrical circuit
The power must be turned off when performing this test
Conductor
Switch
Volt meter
Ohms
OPEN CIRCUIT

Checking for continuity of an electrical circuit
The power must be turned off when performing this test



CLOSED OR COMPLETE CIRCUIT

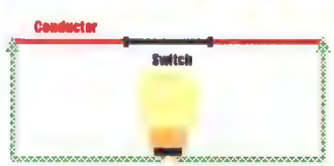
Checking for continuity of an electrical circuit
The power must be turned off when performing this test



Test light

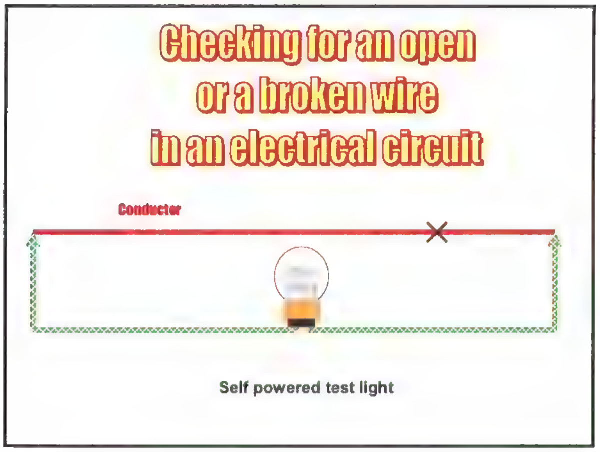
OPEN CIRCUIT

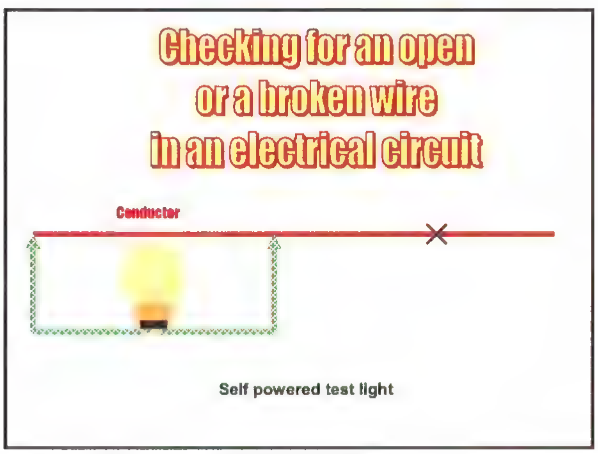
Checking for continuity of an electrical circuit
The power must be turned off when performing this test

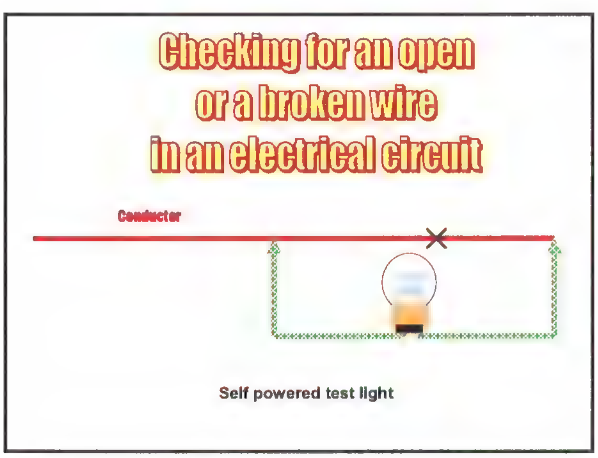


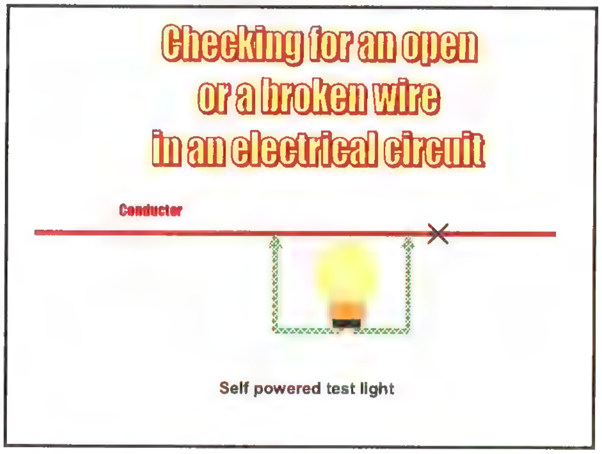
Test light

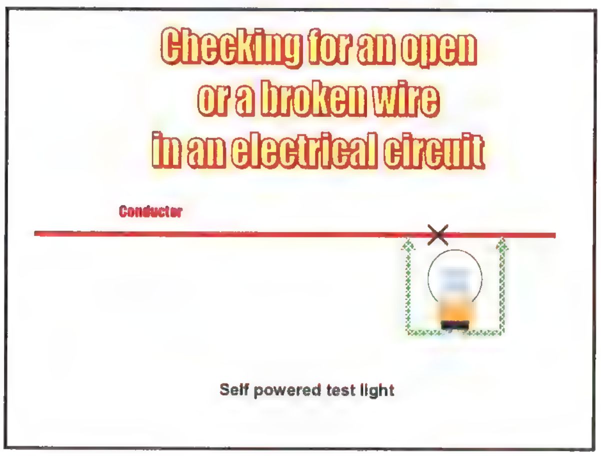
CLOSED OR COMPLETE CIRCUIT

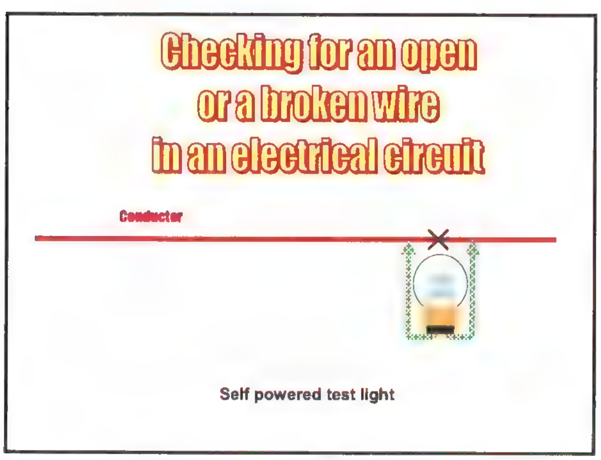

Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light

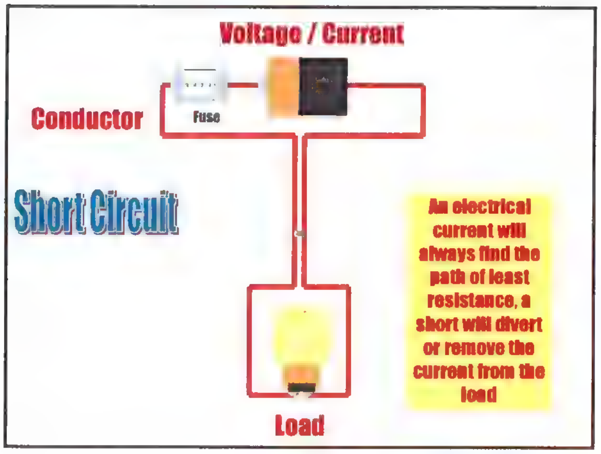

Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light

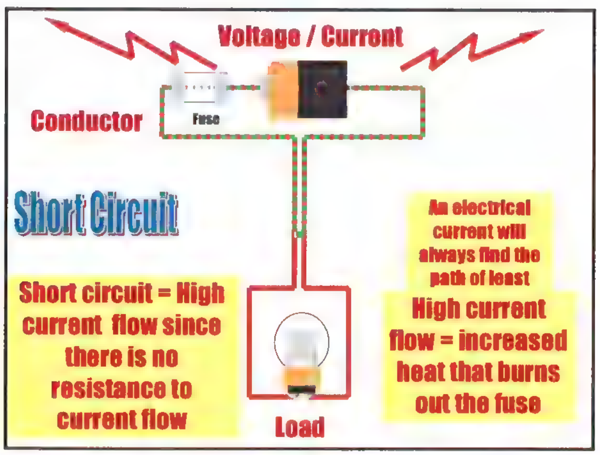

Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light

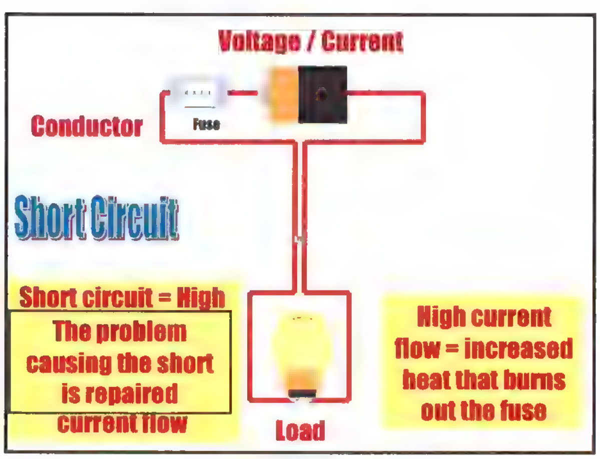

Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light


Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light


Checking for an open
or a broken wire
in an electrical circuit
Conductor
Self powered test light

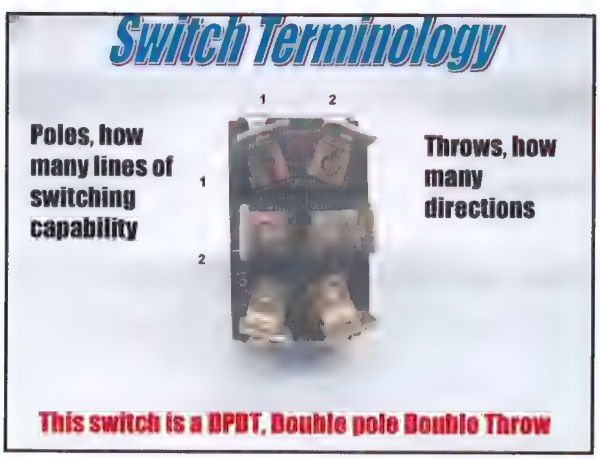

Voltage / Current
Conductor
Fuse
Short Circuit
An electrical current will always find the path of least resistance, a short will divert or remove the current from the load
Load


Voltage / Current
Conductor
Fuse
Short Circuit
Short circuit = High current flow since there is no resistance to current flow
An electrical current will always find the path of least
High current flow = increased heat that burns out the fuse
Load


Voltage / Current
Conductor
Fuse
Short Circuit
Short circuit = High
The problem causing the short is repaired
current flow
High current flow = increased heat that burns out the fuse
Load

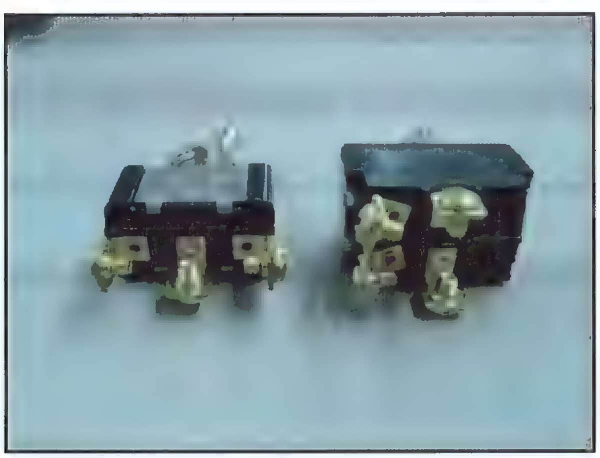

Switch Terminology
1
2
Poles, how many lines of switching capability

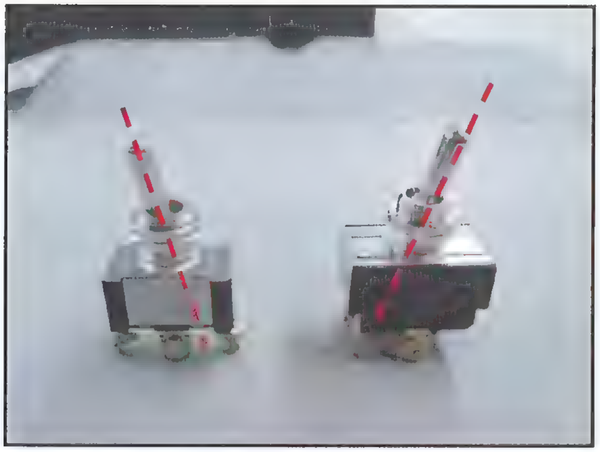

Switch Terminology
1
2
Throws, how many directions


Switch Terminology
1
2
Poles, how many lines of switching capability
1
2
Throws, how many directions
This switch is a DPDT, Double pole Double Throw

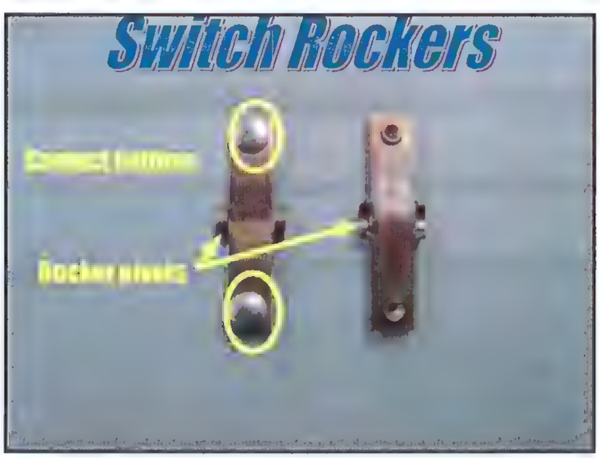
There are many switch types

- SPST= Single Pole Single Throw
- SPDT=Single Pole Double Throw
- DPST=Double Pole Single Throw
- DPDT=Double Pole Double Throw
- Momentary-Sweep run switch, spring loaded to one side, pushbuttons
- DPDT Center off- Managers control



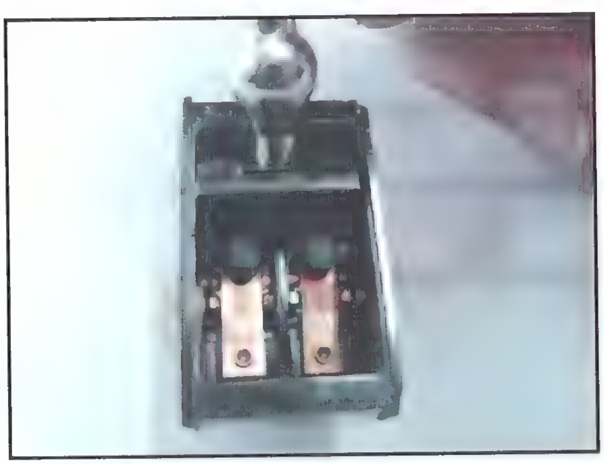



The Inside Scoop
Rocker supports, are the common terminals
Contact buttons

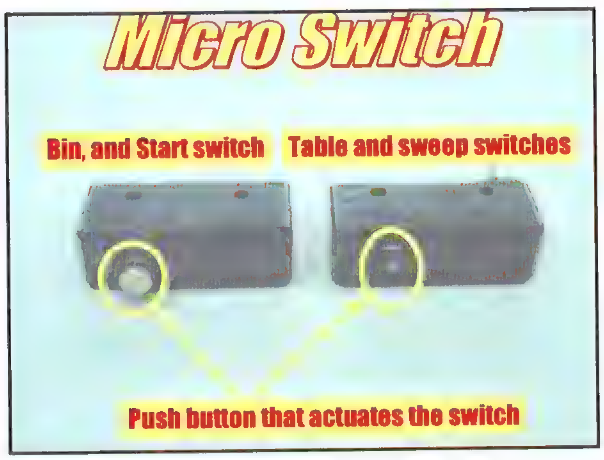

Switch Rockers


Rocker installed in the switch body


Switch Toggle and followers
Spring loaded buttons




Pushbutton switch
These switches can be configured in many ways, momentary ON or OFF, push once to turn on push again to turn off and so on..............


Micro Switch
Bin, and Start switch
Table and sweep switches
Push button that actuates the switch

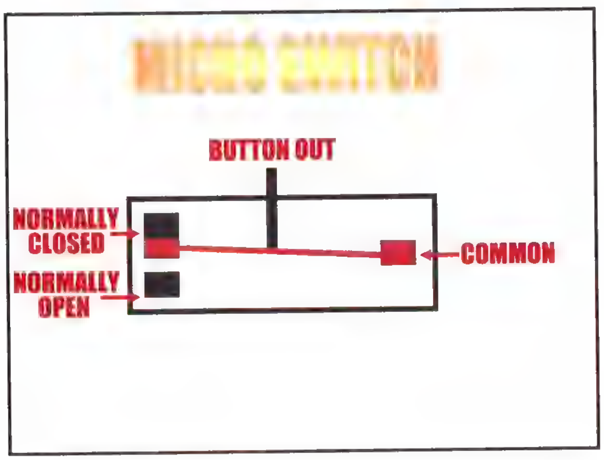

Switch Contacts
Common
Common
Normally open
Normally open
Normally closed
Normally closed

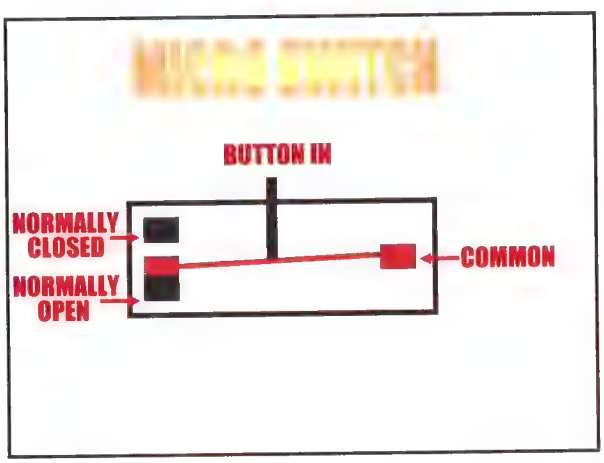

A Switch To Avoid
Unimax brand switches, these were primarily used on scorer start switch circuits


Inside the Micro Switch
Normally closed contact
Rocker
Common
Spring
Normally open contact

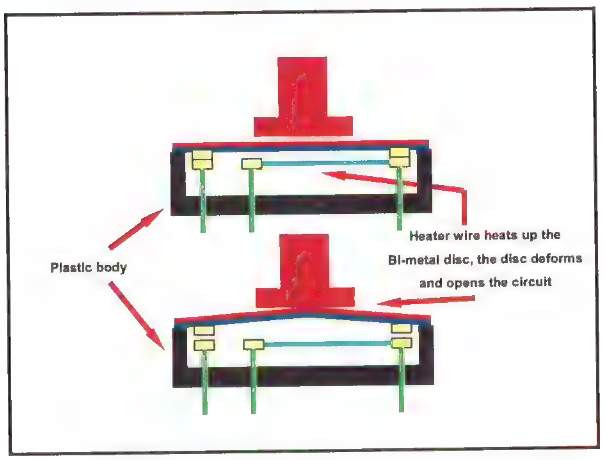

Switch with the button out
Common and the normally closed terminals make contact

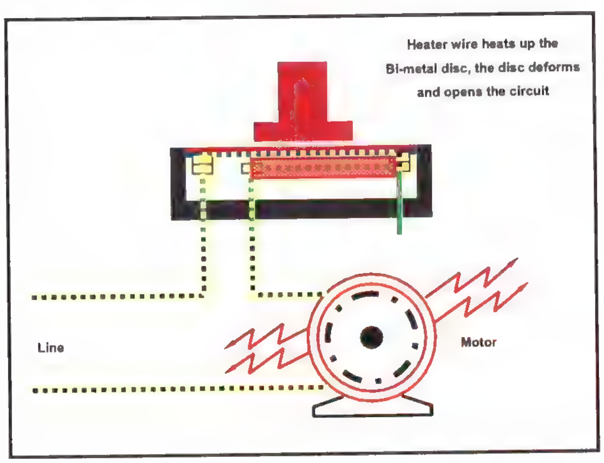

Switch with the button pushed in
The common and normally open
terminals make contact

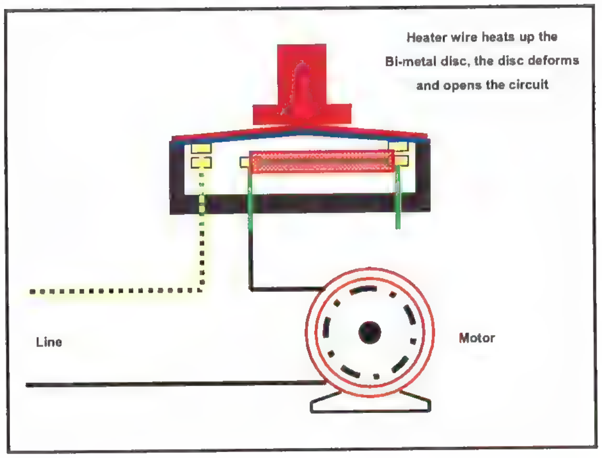

MICRO SWITCH
BUTTON OUT
NORMALLY
CLOSED
NORMALLY
OPEN
COMMON

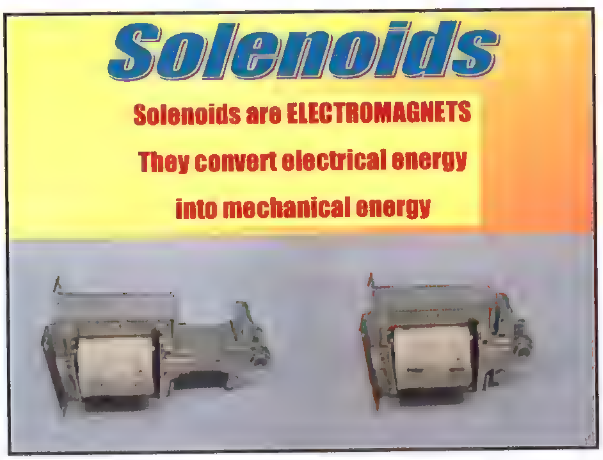

MICRO SWITCH
BUTTON IN
NORMALLY
CLOSED
NORMALLY
OPEN
COMMON

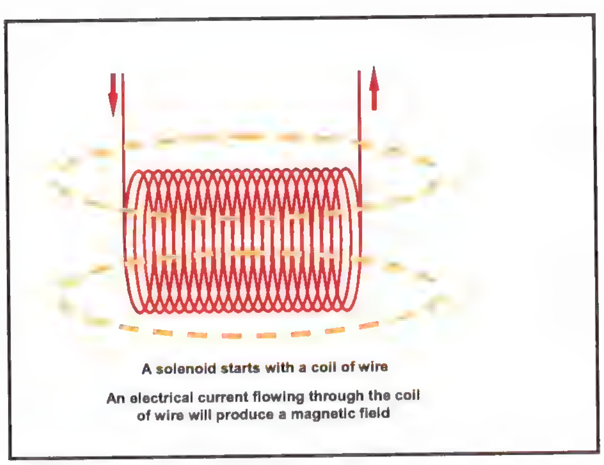

Klixon circuit protection

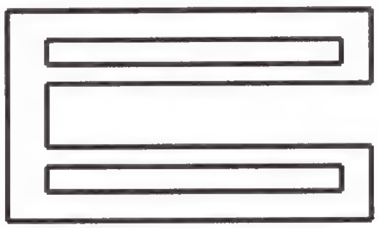

Plastic body
Heater wire heats up the
Bi-metal disc, the disc deforms
and opens the circuit


Heater wire heats up the
Bi-metal disc, the disc deforms
and opens the circuit
Line
Motor

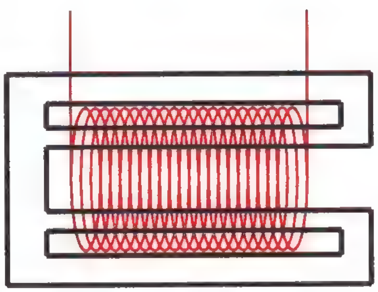

Heater wire heats up the
Bi-metal disc, the disc deforms
and opens the circuit
Line
Motor


Solenoids
Solenoids are ELECTROMAGNETS
They convert electrical energy
into mechanical energy

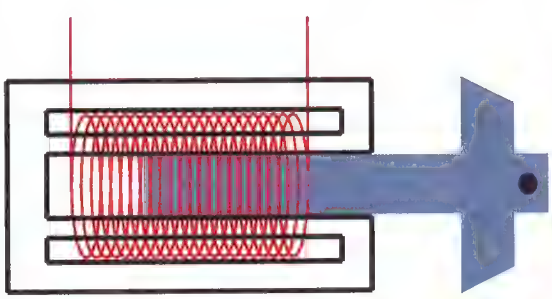

A solenoid starts with a coil of wire
An electrical current flowing through the coil
of wire will produce a magnetic field



A laminated iron core helps to intensify the magnetic field

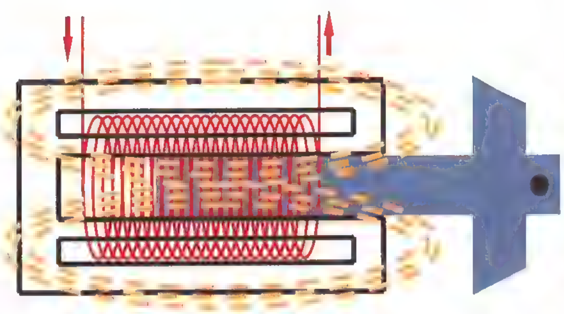


The coil of wire is placed within the iron core



A movable plunger is placed within the iron core

CHECK OHMS FOR GOOD

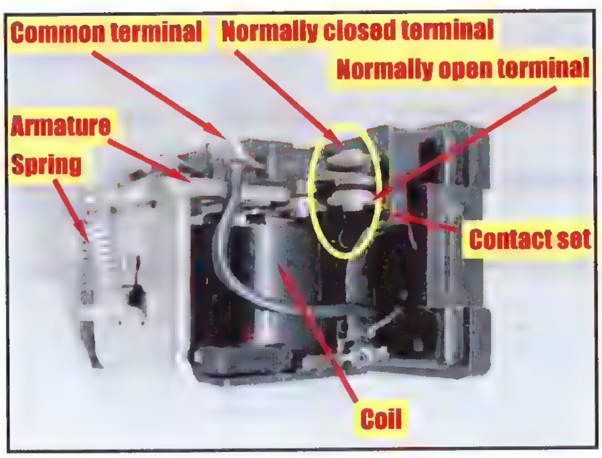


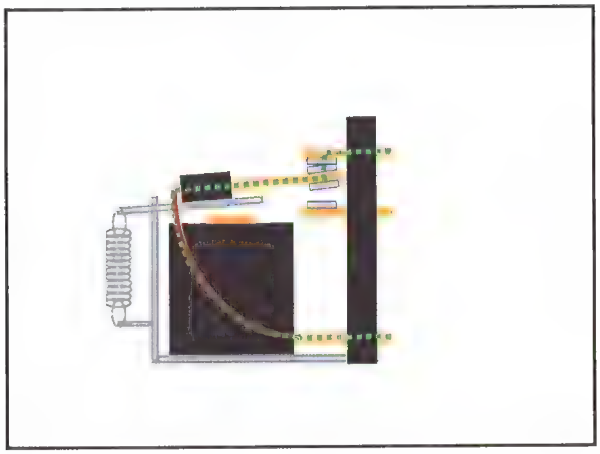
When an electric current flows through coil of wire a magnetic field develops this magnetic field draws the plunger into the iron core

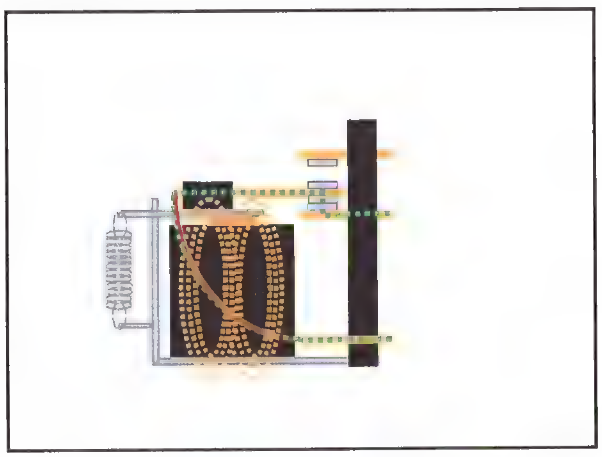
Relays

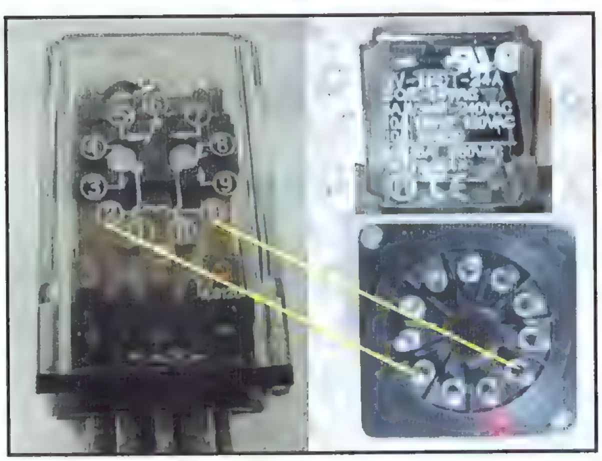
What are relays ???

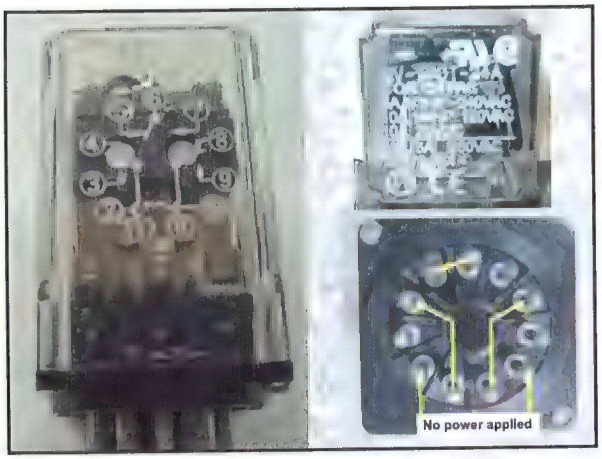
Relays are a combination of a solenoid and a switch

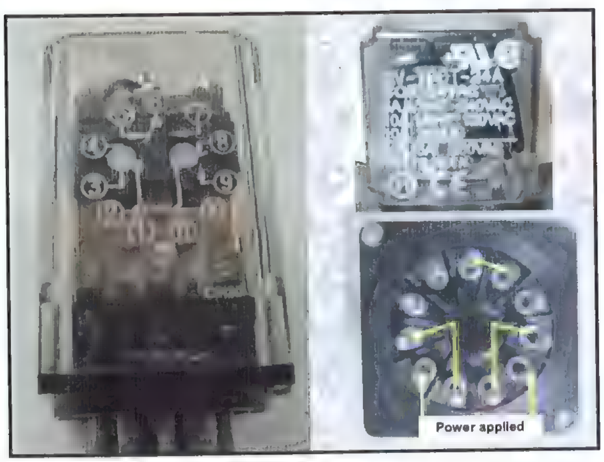




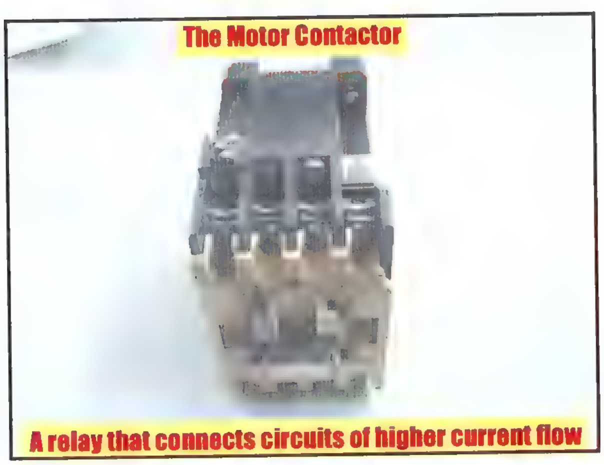


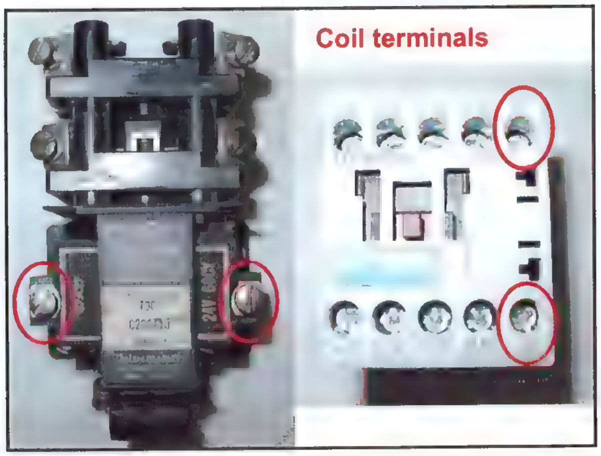


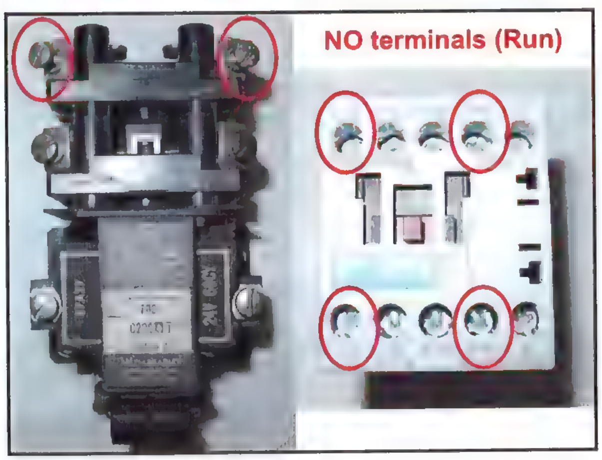


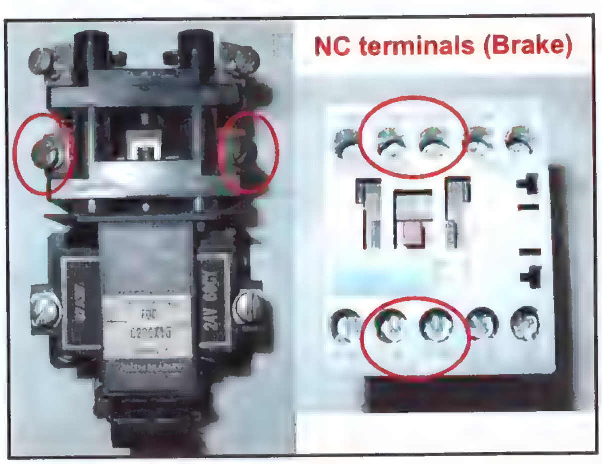


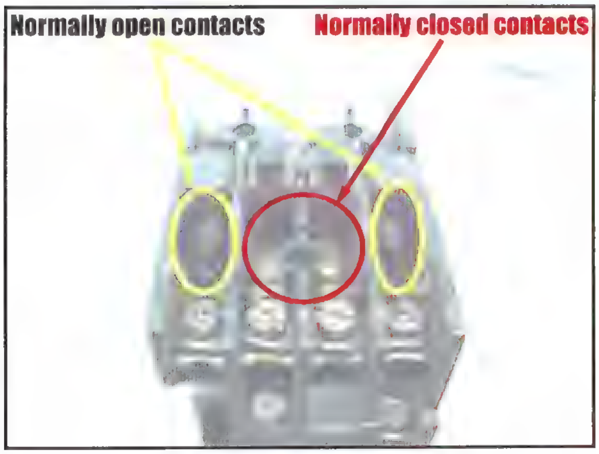
USE T2 TRANS TO TEST
9pin SOCKET LIGHT 5/6 6/7
1/4 1/3 11/8 11/9

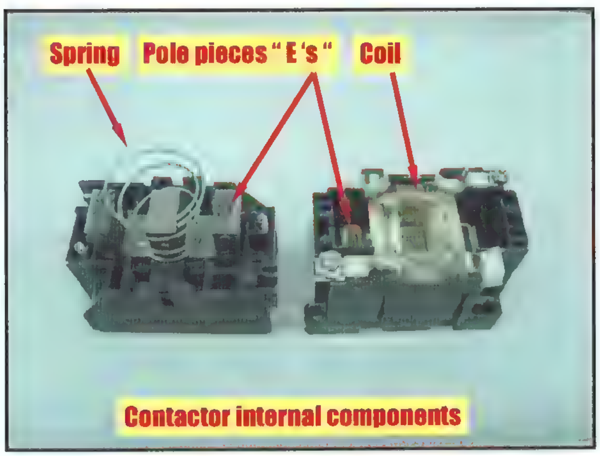



Coil terminals

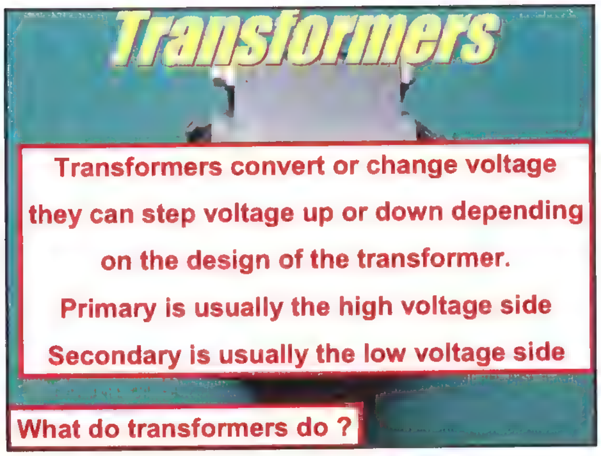

NO terminals (Run)


NC terminals (Brake)


Normally open contacts
Normally closed contacts

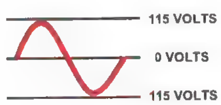

Spring
Pole pieces " E's "
Coil
Contactor internal components


Transformers
What do transformers do ?



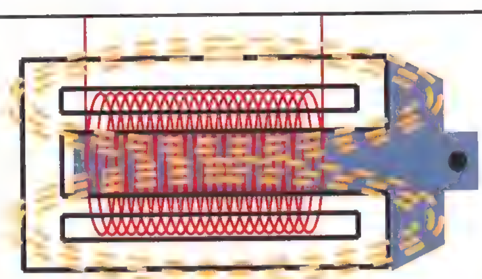
Transformers work using AC or alternating current

Alternating current changes directions 60 times per second



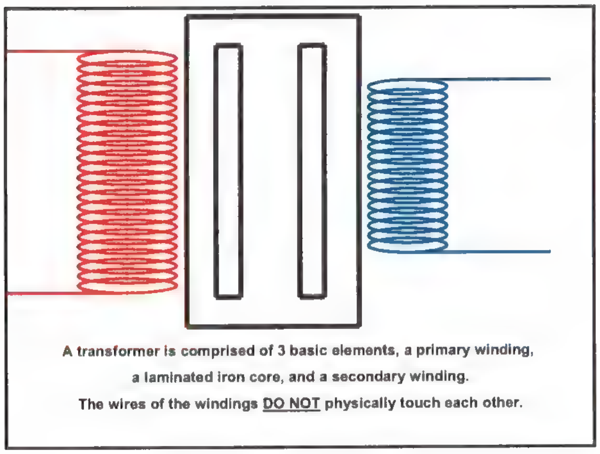
Transformers change voltage by a process called

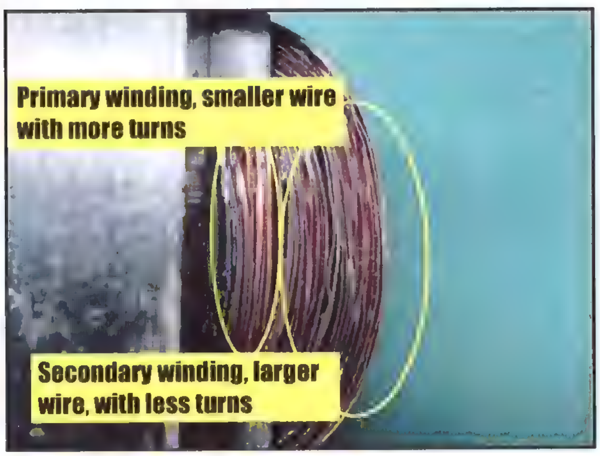
INDUCTION

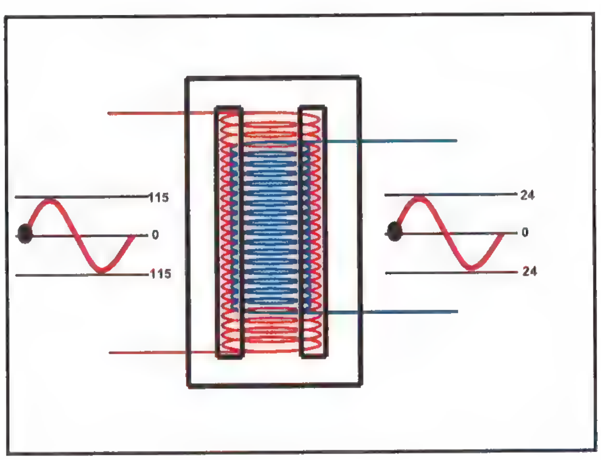


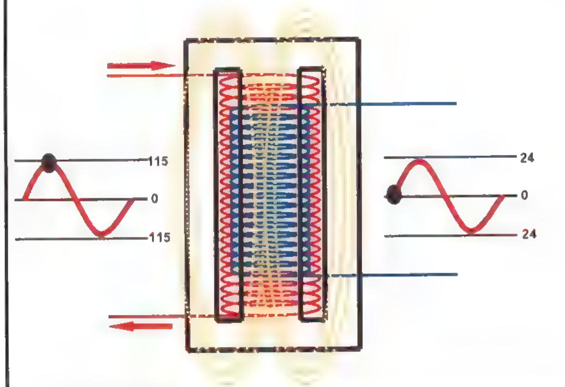
We have seen that a current flow through a coil of wire will produce a moving magnetic field.

Therefore a moving magnetic field surrounding a coil of wire will produce an electric current

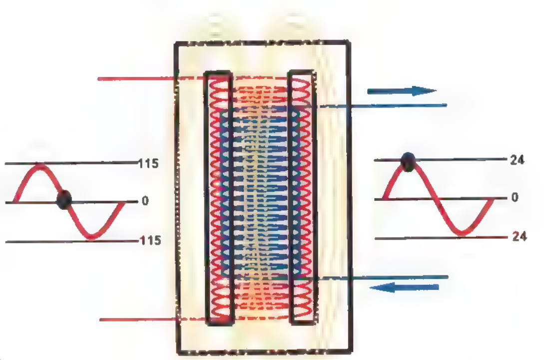

A transformer is comprised of 3 basic elements, a primary winding,
a laminated iron core, and a secondary winding.
The wires of the windings DO NOT physically touch each other.


Primary winding, smaller wire with more turns
Secondary winding, larger wire, with less turns

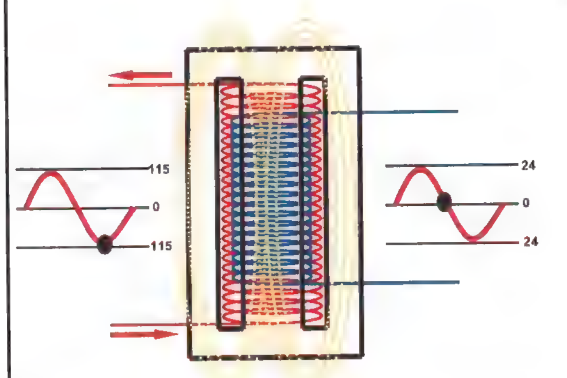

115
0
115
24
0
24



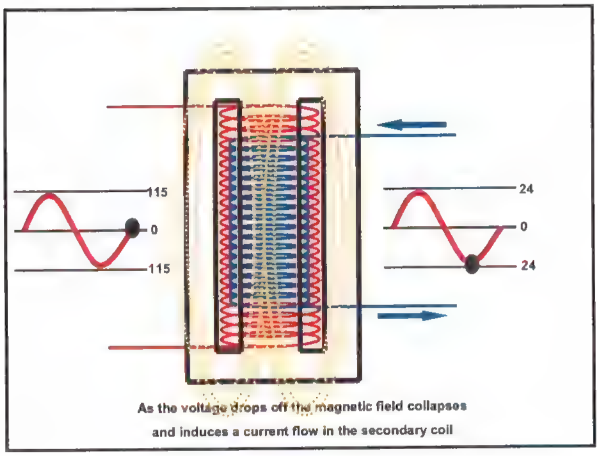
As the primary winding is energized a magnetic field develops within the iron core



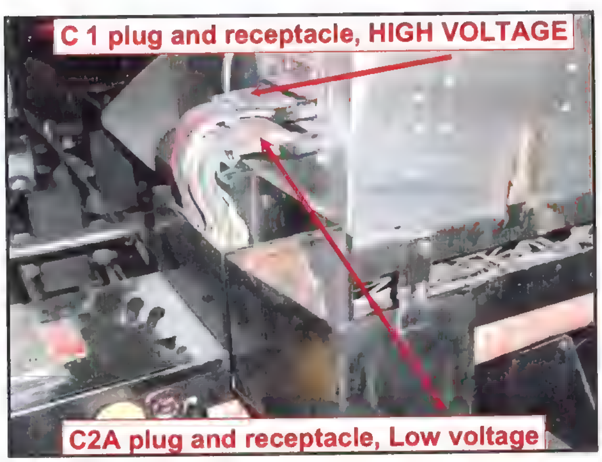
As the voltage drops off the magnetic field collapses
and induces a current flow in the secondary coil

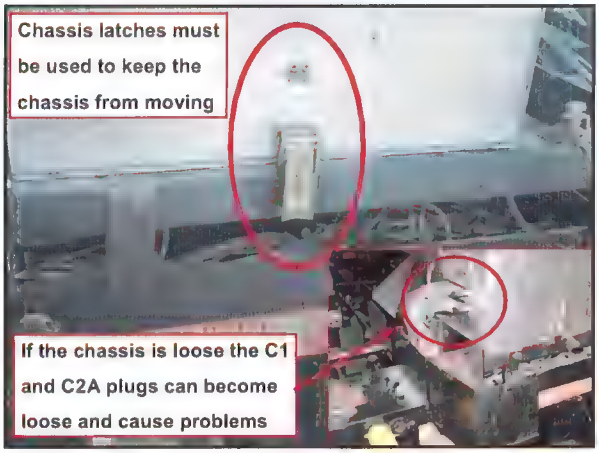


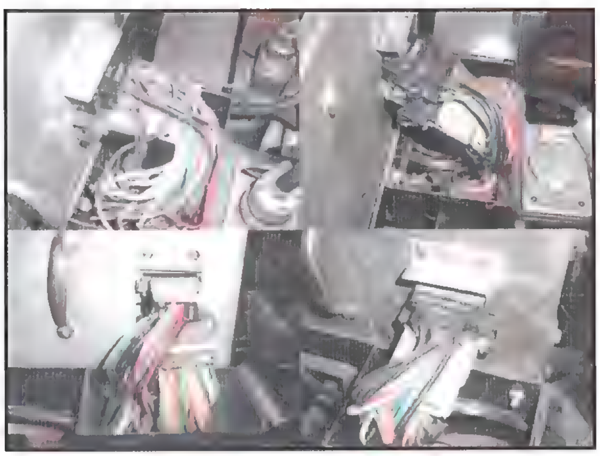
As the voltage peaks the opposite direction in the primary winding a magnetic field develops

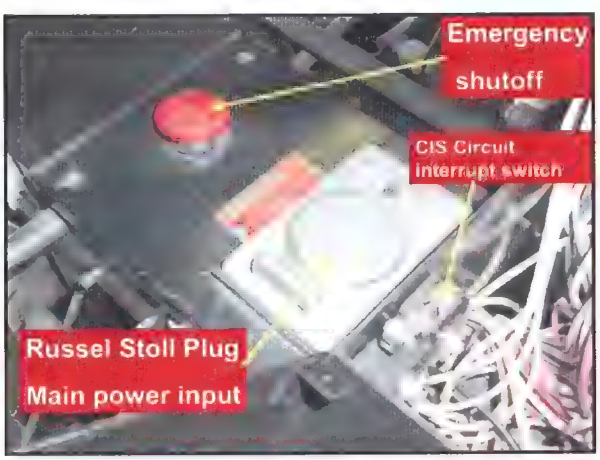


Control Switches Plugs and Motors




Chassis latches must be used to keep the chassis from moving
If the chassis is loose the C1 and C2A plugs can become loose and cause problems




Emergency shutoff
CIS Circuit interrupt switch
Russel Stoll Plug Main power input

AMF BOWLING INC.
PINSPOTTER TRAINING

SWITCHES

[illegible]

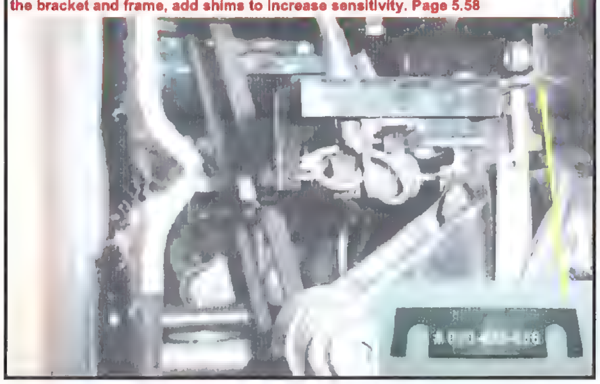
Pg 11

AMF BOWLING INC.
PINSPOTTER TRAINING

SWITCHES

[illegible]	[illegible] THE NUMBER NINE PIN [illegible] PRESENT [illegible]
[illegible]	RUNS [illegible] REAR OF MACHINE [illegible] MANUAL
[illegible]	[illegible] MANUAL [illegible]
[illegible]	[illegible] BALL OR SECOND [illegible] MANUAL [illegible]
[illegible]	[illegible]
[illegible]	[illegible] APPROACH [illegible] BOWLER CONTROLLED

Start switch - SS, LOCATED UNDER THE BACKEND MOTOR,
used to initiate machine cycle, adjustment is made by inserting shims between the bracket and frame, add shims to increase sensitivity. Page 5.58



Off spot switch - OS, LOCATED ON THE TABLE TORQUE TUBE, tells the chassis an off spot condition exists. The chassis will disable sweep run, stop the table shaft at one revolution, and switch machine to 2nd ball logic. The sweep will remain down and must be raised by depressing sweep reverse and sweep run switches at the same time.

Gripper switch - GS, LOCATED ON EVERY RESPOT CELL, tells the chassis that a pin is present in the respot cell when the cell is closed on the neck of the pin.

Spring helps the switch open, if missing the machine may fail on a strike cycle, "no strike"

Gripper switch adjusting bolt

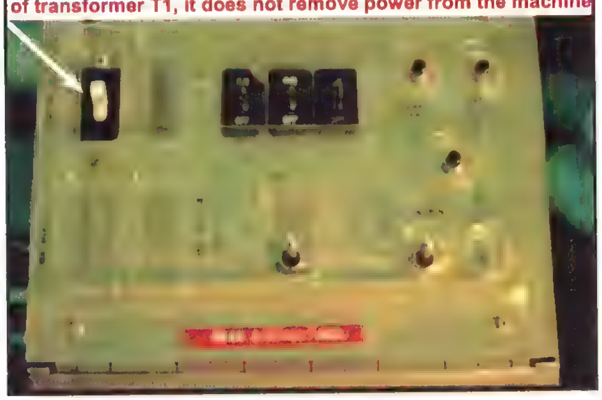
Newer machines use an allen screw

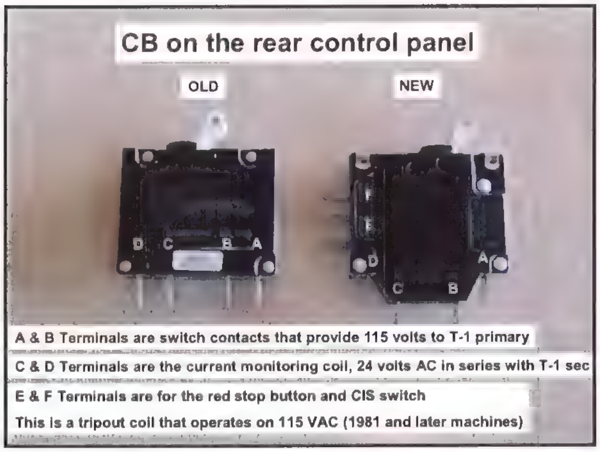
Gripper protection switch - GP, LOCATED ON THE REAR OF THE TABLE BETWEEN THE 8 AND 9 CELLS, stops the table from running if the respot cells are partially closed, the switch is largely unused since the cast aluminum cell fingers were replaced with steel fingers

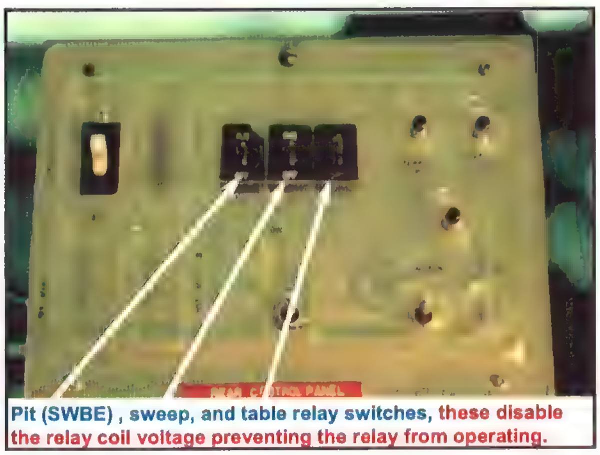
Bin switch - BS, LOCATED BEHIND THE 5 PIN SLOT OF THE BIN

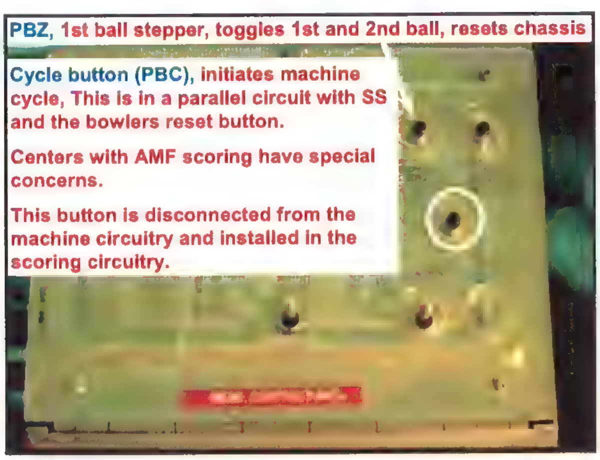
This switch tells the chassis there in a pin present in the # 9 bin location

Master CB, when tripped this opens the Primary winding of transformer T1, it does not remove power from the machine




CB on the rear control panel
OLD
NEW
D C B A
D C B A
A & B Terminals are switch contacts that provide 115 volts to T-1 primary
C & D Terminals are the current monitoring coil, 24 volts AC in series with T-1 sec
E & F Terminals are for the red stop button and CIS switch
This is a tripout coil that operates on 115 VAC (1981 and later machines)


Pit (SWBE) , sweep, and table relay switches, these disable the relay coil voltage preventing the relay from operating.


PBZ, 1st ball stepper, toggles 1st and 2nd ball, resets chassis
Cycle button (PBC), initiates machine cycle, This is in a parallel circuit with SS and the bowlers reset button.
Centers with AMF scoring have special concerns.
This button is disconnected from the machine circuitry and installed in the scoring circuitry.

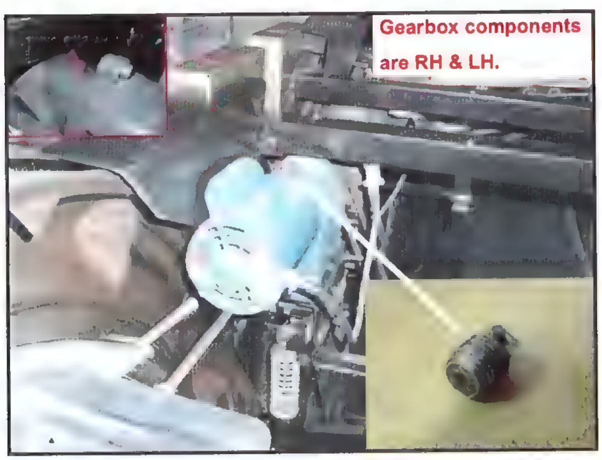
Sweep run switch - SWS, this switch grounds the sweep relay allowing the sweep to run, there is an additional circuit connected to this switch, the start switch is in a series circuit with the sweep run switch. Whenever the SWS is used it disables the SS circuit.

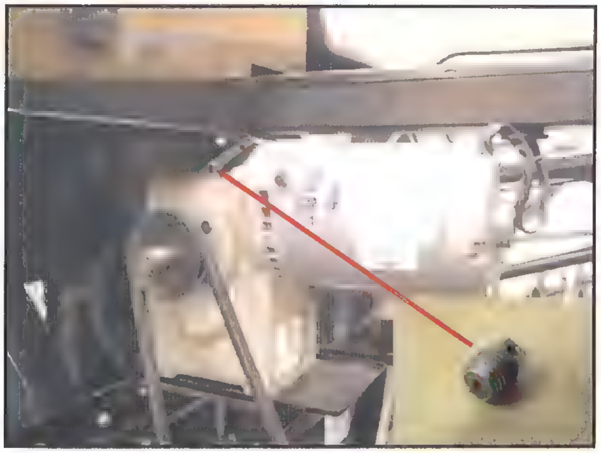
Sweep reverse switch - SWSR, this switch is a momentary DPDT switch used to reverse the direction of the sweep motor. The start winding circuit of the sweep motor run back to this switch.

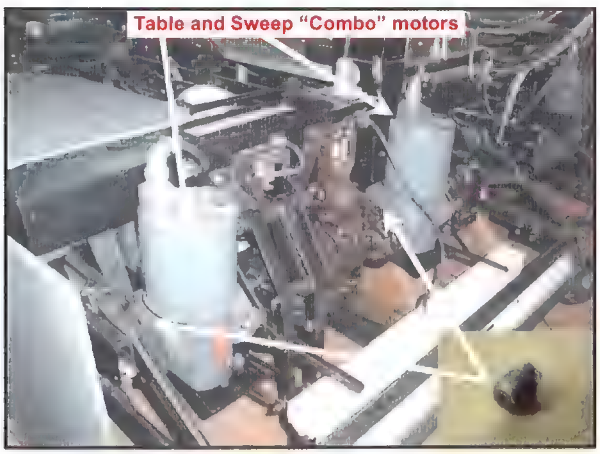
AMF BOWLING INC.
PINSPOTTER TRAINING

MOTORS

SOLENOIDS

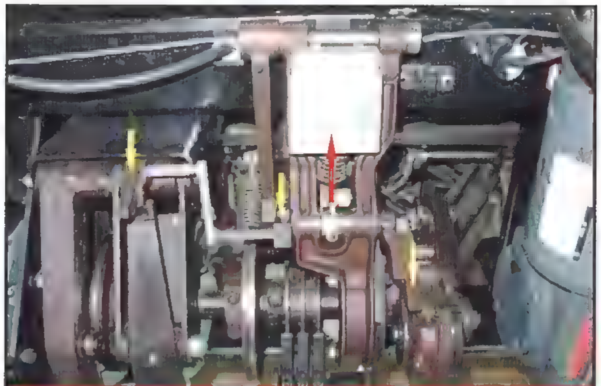




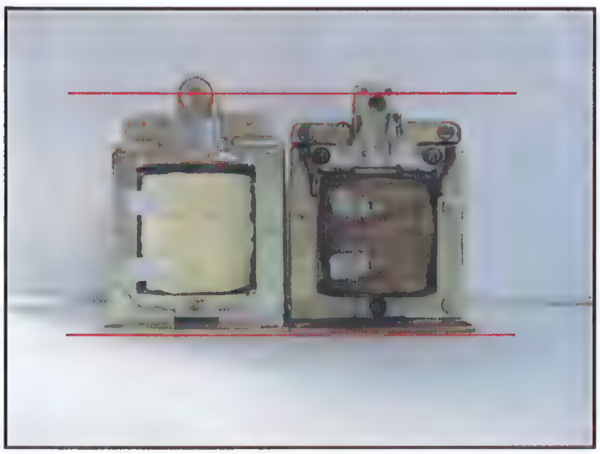


Combo Motors

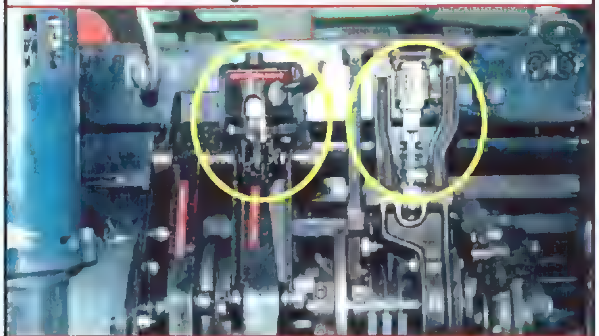
- Complete assemblies can be interchanged GE to Westinghouse, Westinghouse to National
- Components cannot be interchanged across manufacturers
- Vent plugs
- Gearbox lubricant, use the proper AMF specified gear lube.



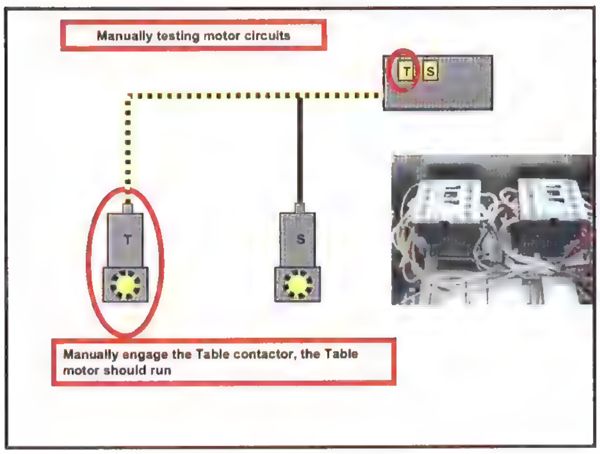
Spot solenoid, performs 3 functions, unlatches the table drive to allow a long stroke of the table, unblocks the shuttle stop, and latches the spot lever to allow the cups to rotate

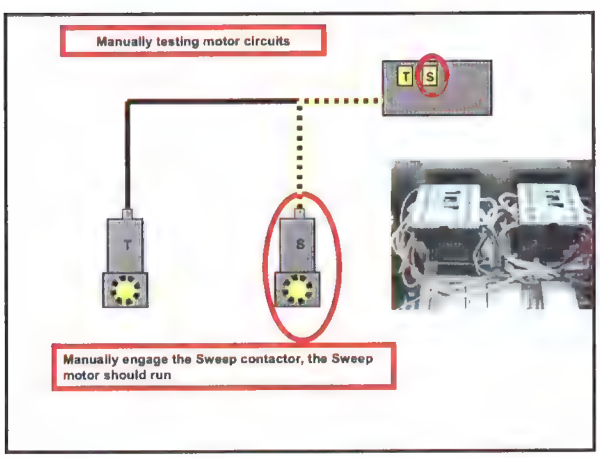


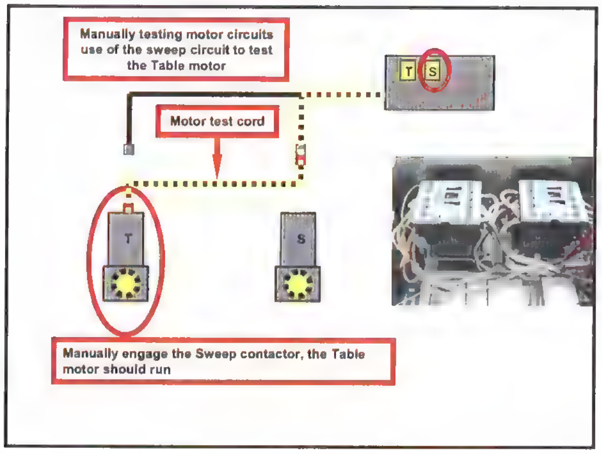
Spot solenoid, performs 2 functions, unblocks the shuttle stop, unlatches the table drive to allow a long stroke of the table

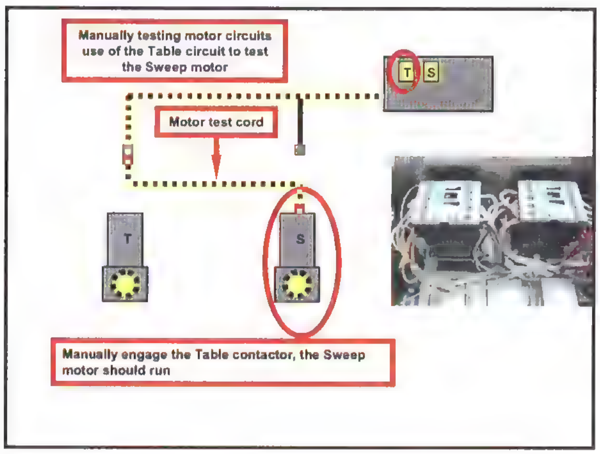


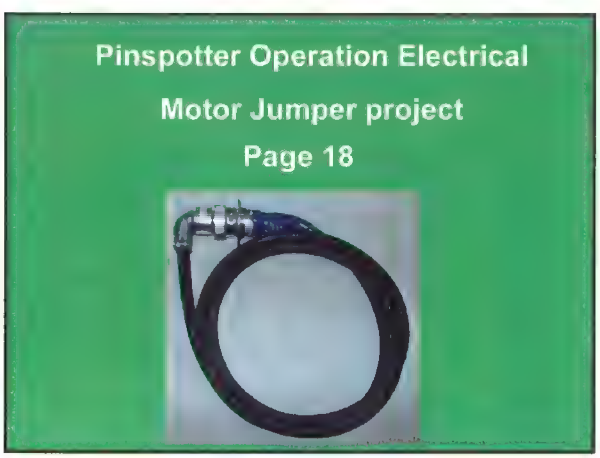
Respot solenoid, releases to latch the spot lever to enable the cups to rotate, this had problems with residual magnetism, it was replaced with a mechanical linkage

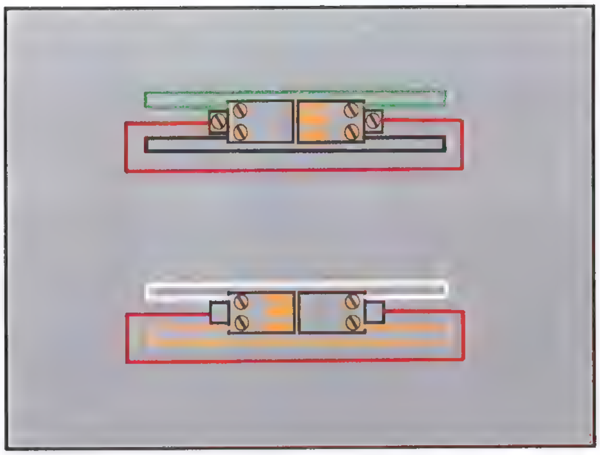


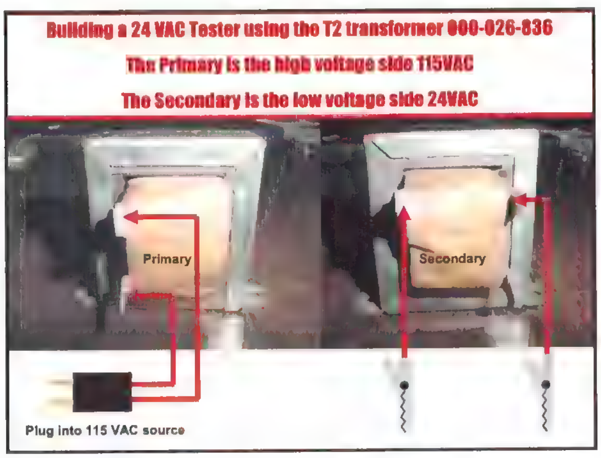


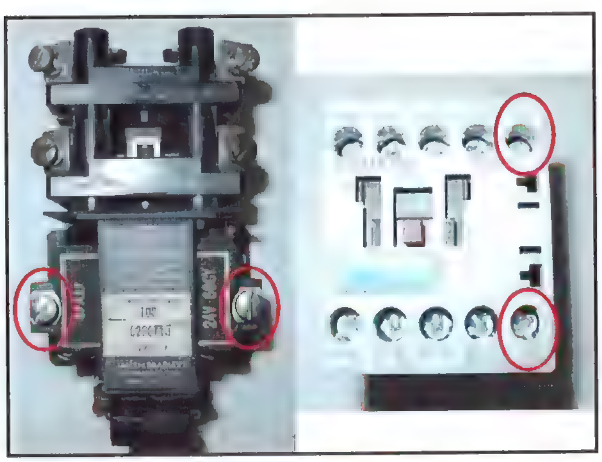

Manually testing motor circuits use of the sweep circuit to test the Table motor
T
S
Motor test cord
T
S
Manually engage the Sweep contactor, the Table motor should run


Manually testing motor circuits use of the Table circuit to test the Sweep motor
T
S
Motor test cord
T
S
Manually engage the Table contactor, the Sweep motor should run


Pinspotter Operation Electrical
Motor Jumper project
Page 18

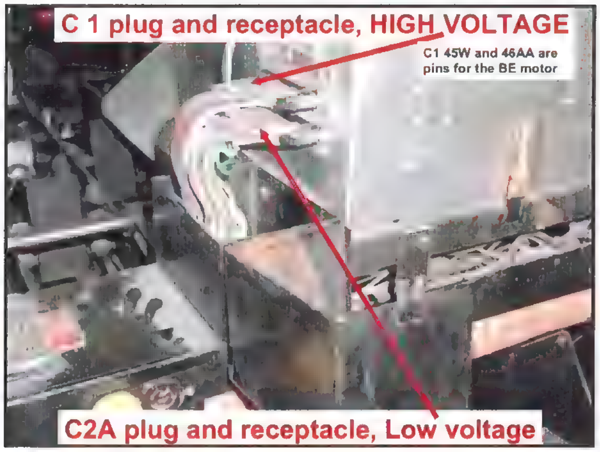


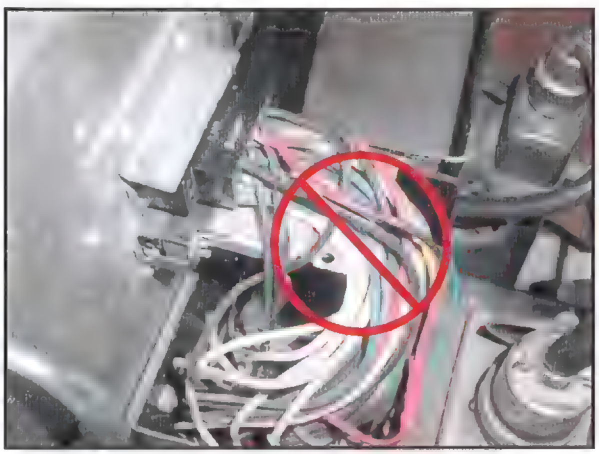

Building a 24 VAC Tester using the T2 transformer 000-026-836
The Primary is the high voltage side 115VAC
The Secondary is the low voltage side 24VAC
Primary
Secondary
Plug into 115 VAC source

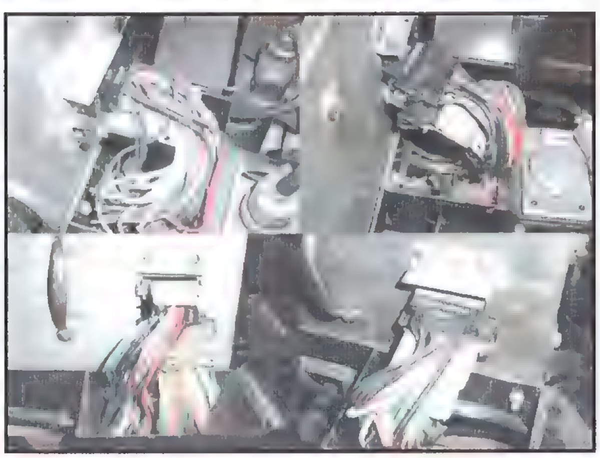



BASIC CRIMP TECHNIQUES

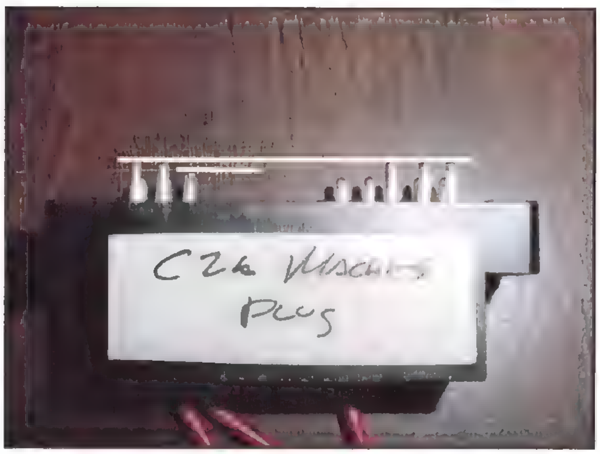

NO FUNKY
WIRING
ALLOWED

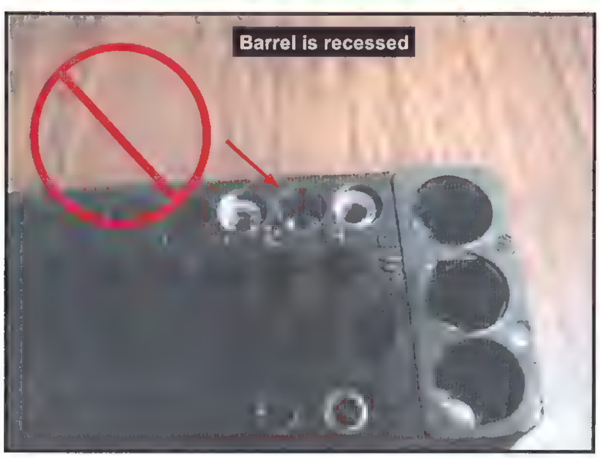

C 1 plug and receptacle, HIGH VOLTAGE
C1 45W and 46AA are pins for the BE motor
C2A plug and receptacle, Low voltage





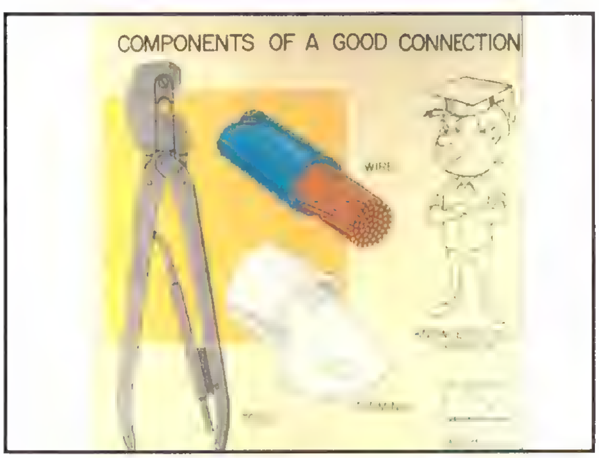

Drag test, there should be an equal amount of tension in each female socket
AMP 2002 84
Remove the main power plug first

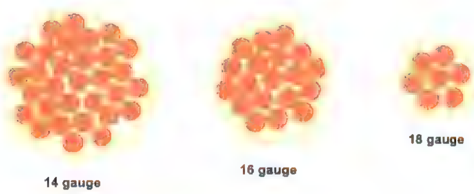

C2b Machine Plug


Barrel is recessed

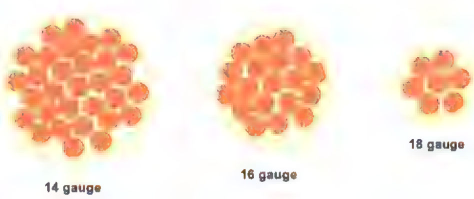

030-004-031 Pin extractor


Female socket 760-019-201
Male terminal pin 760-011-197

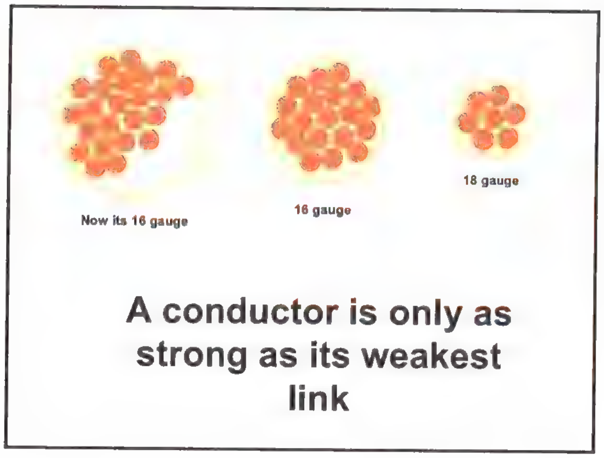

COMPONENTS OF A GOOD CONNECTION
WIRE

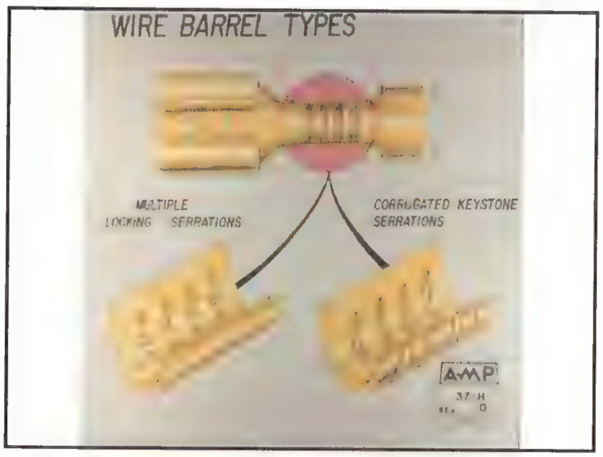


A larger wire, has a greater capacity to carry an electrical current



Care must be taken when stripping a wire so you do not remove strands of wire thereby reducing its cross sectional area.


Now its 16 gauge
16 gauge
18 gauge
A conductor is only as strong as its weakest link

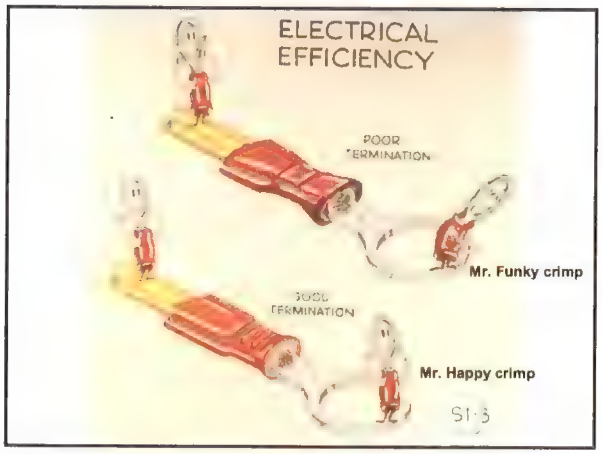

WIRE BARREL TYPES
MULTIPLE LOCKING SERRATIONS
CORRUGATED KEYSTONE SERRATIONS
AMP

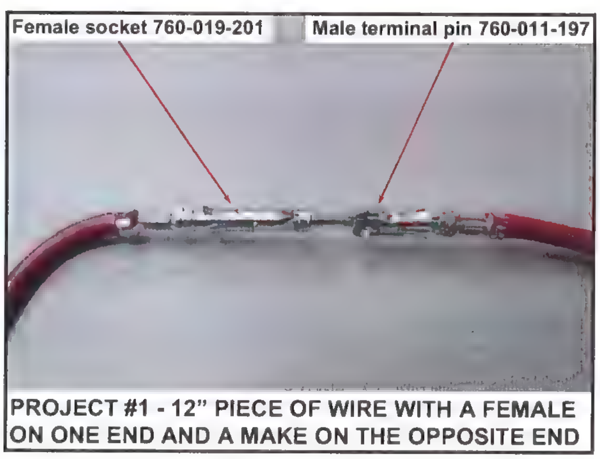

792- 512- 019

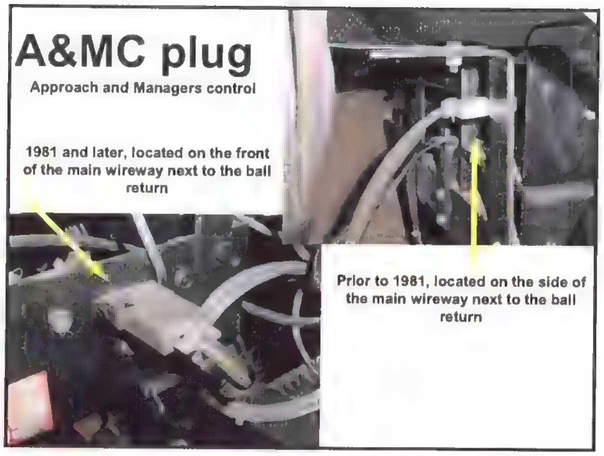

WIRE
A
B
C
D


E
F
G
INSUL
10-24


COMPLETED CRIMP
AMP

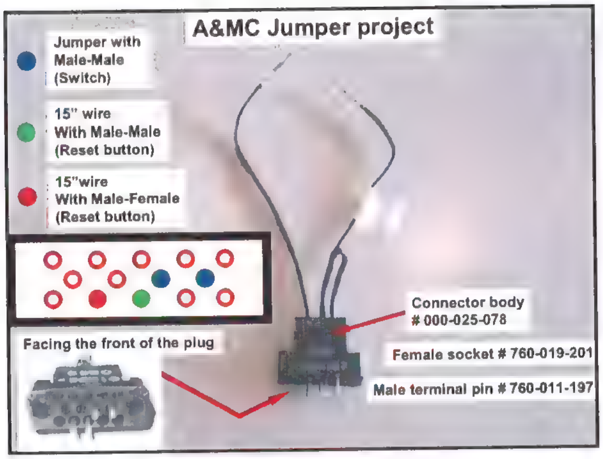

ELECTRICAL EFFICIENCY
POOR TERMINATION
Mr. Funky crimp
Mr. Happy crimp

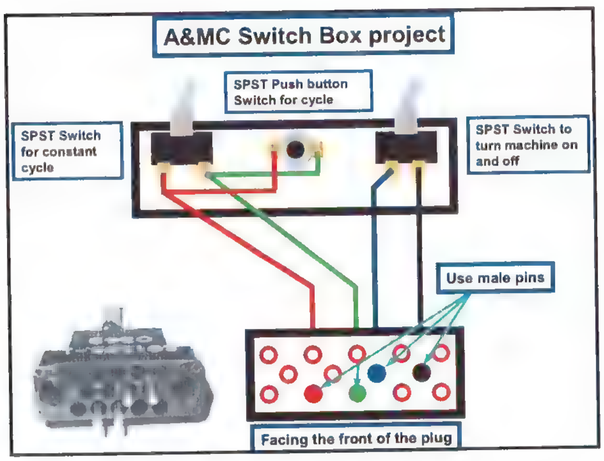

Female socket 760-019-201
Male terminal pin 760-011-197
PROJECT #1 - 12” PIECE OF WIRE WITH A FEMALE ON ONE END AND A MAKE ON THE OPPOSITE END



Approach and Managers control box

Approach and Managers control box





AMF BOWLING INC.
PINSPOTTER TRAINING

82-70 WITH 9800 CHASSIS

CAMS

[illegible] TABLE UP AND STOPS TABLE AT ZERO [illegible]

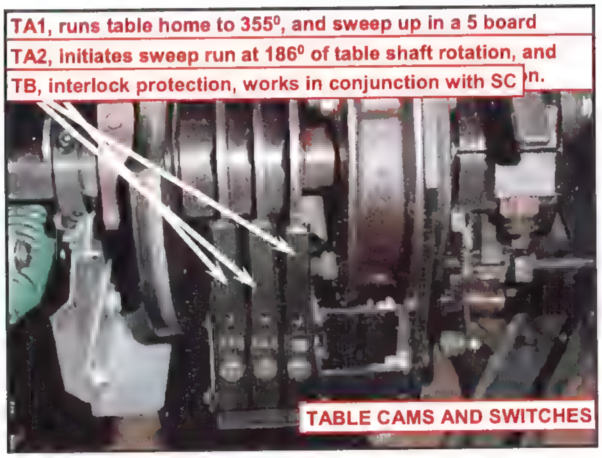
[illegible] SWEEP RUN THROUGH AND STARTS SWEEP UP AT END OF CYCLE (260

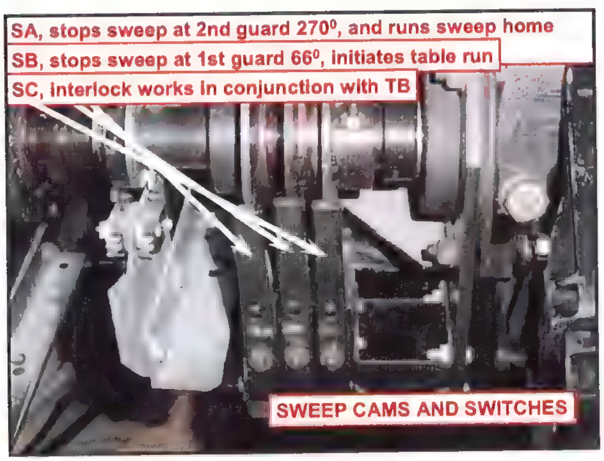
CONTROLS TABLE SWEEP INTERLOCK

[illegible] SWEEP AT 2ND GUARD RUNS SWEEP UP AND [illegible]

[illegible] SWEEP AT FIRST GUARD 66 [illegible] STARTS TABLE [illegible] 186

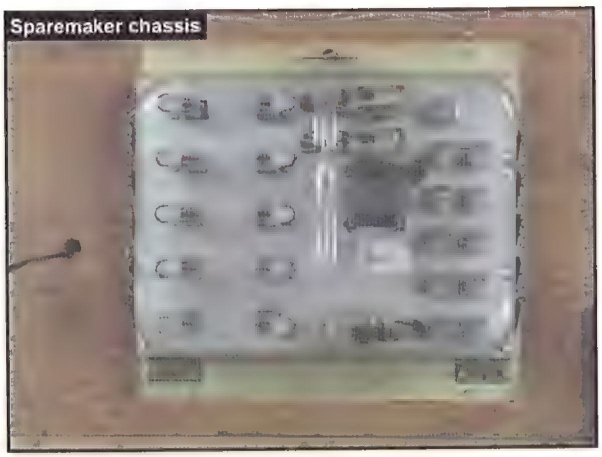
CONTROLS TABLE SWEEP INTERLOCK

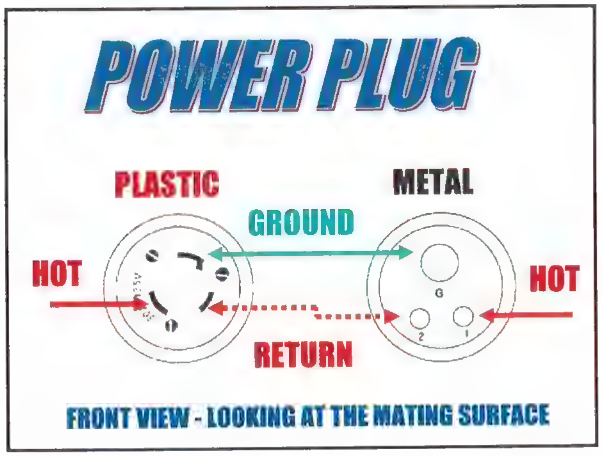

TA1, runs table home to 355^0, and sweep up in a 5 board
TA2, initiates sweep run at 186^0 of table shaft rotation, and
TB, interlock protection, works in conjunction with SC
TABLE CAMS AND SWITCHES

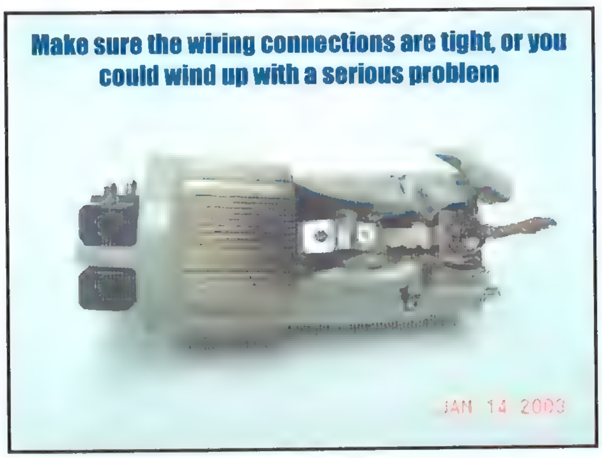

SA, stops sweep at 2nd guard 270^0, and runs sweep home
SB, stops sweep at 1st guard 66^0, initiates table run
SC, interlock works in conjunction with TB
SWEEP CAMS AND SWITCHES

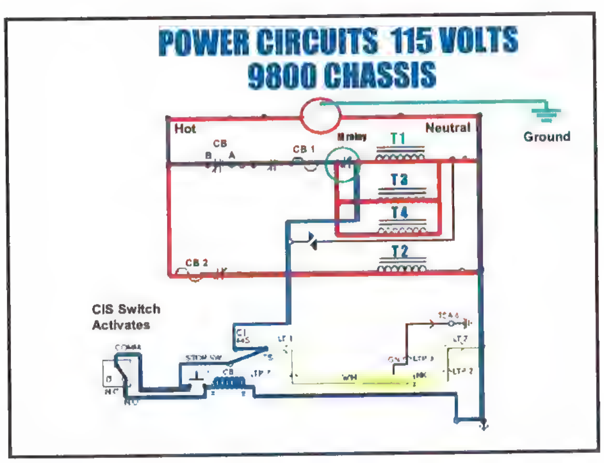

AMF Ball Detector

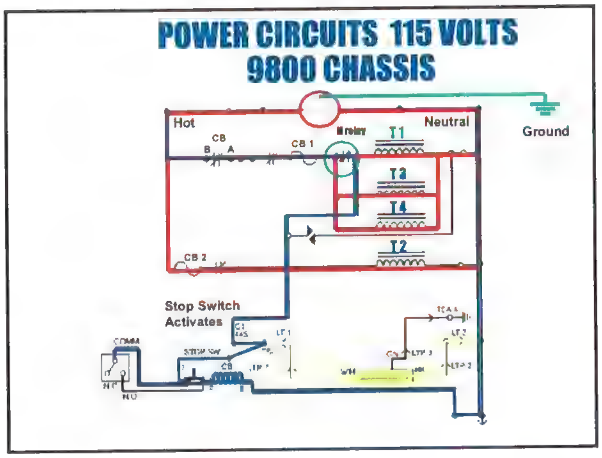
Setting #	switch 1	switch 2	switch 3	comments
7	off	off	off	Maximum delay
6	on	off	off	
5	off	on	off	
4	on	on	off	
3	off	off	on	
2	on	off	on	
1	off	on	on	Minimum delay
0	on	on	on	No delay
Switch #4 if present does not affect anything.				

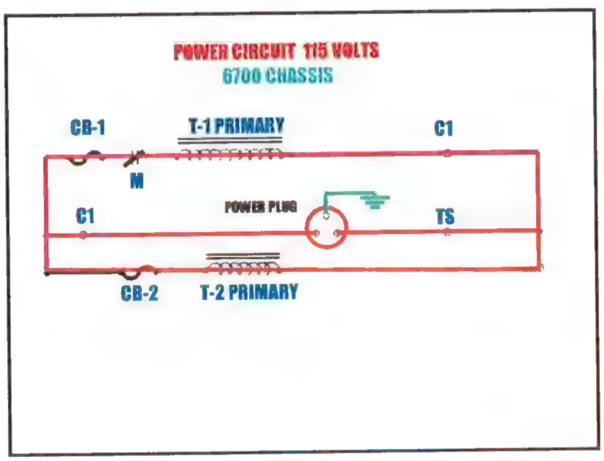

Sparemaker chassis

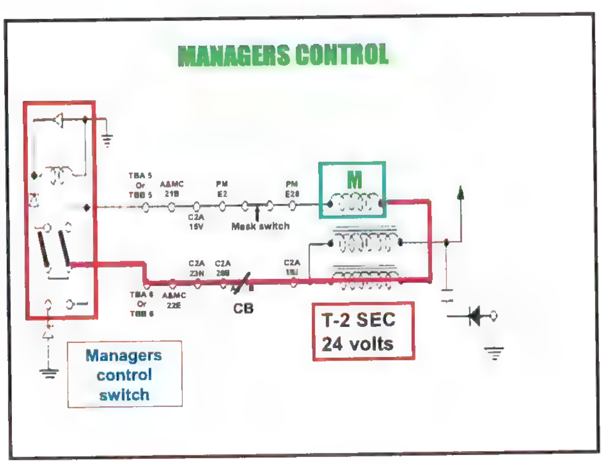

POWER PLUG
PLASTIC
METAL
GROUND
HOT
HOT
G
RETURN
FRONT VIEW - LOOKING AT THE MATING SURFACE

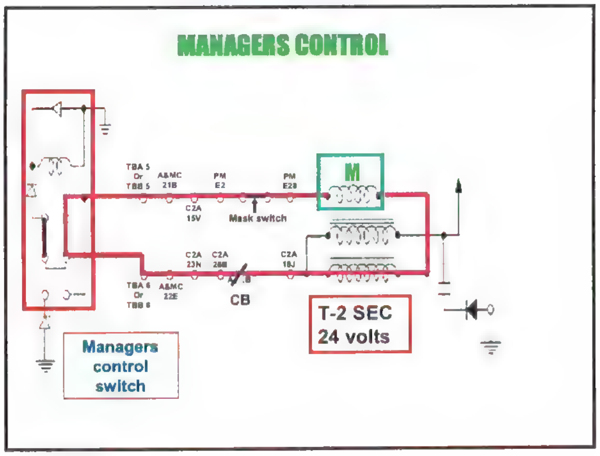

Make sure the wiring connections are tight, or you could wind up with a serious problem
JAN 14 2003

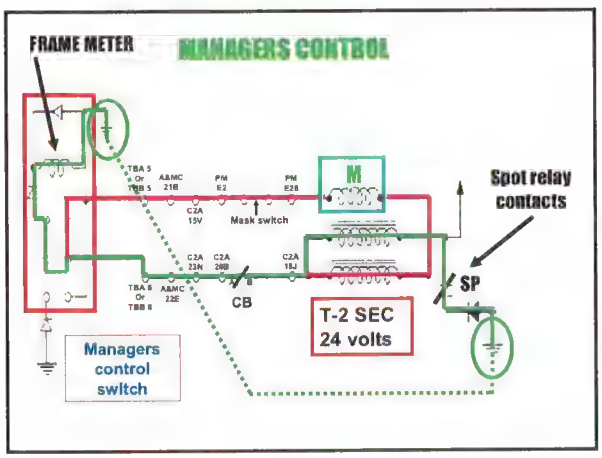

POWER CIRCUITS 115 VOLTS
9800 CHASSIS
Hot
Neutral
Ground
CB
CB 1
T1
T3
T4
T2
CB 2
CIS Switch
Activates

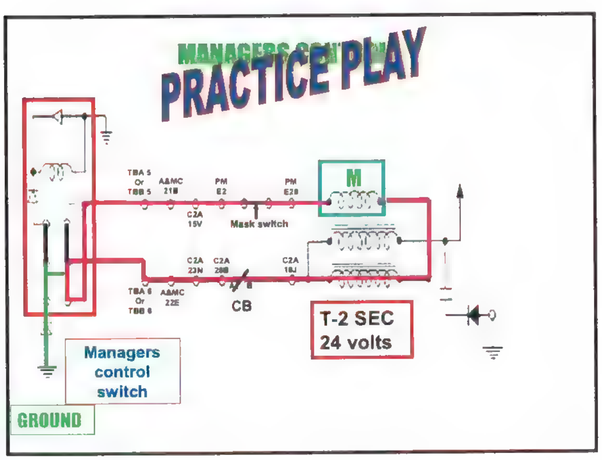

POWER CIRCUITS 115 VOLTS
9800 CHASSIS
Hot
Neutral
Ground
CB
CB 1
T1
T3
T4
T2
CB 2
Stop Switch
Activates

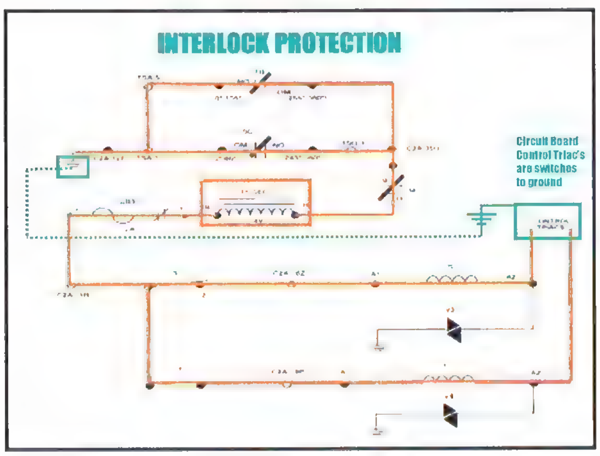

POWER CIRCUIT 115 VOLTS
6700 CHASSIS
CB-1
T-1 PRIMARY
C1
M
C1
POWER PLUG
TS
CB-2
T-2 PRIMARY

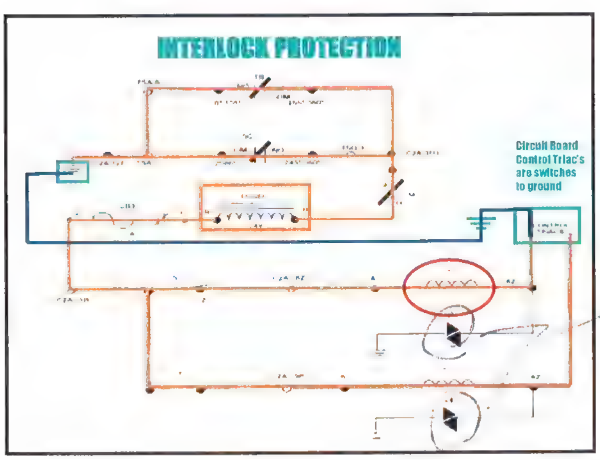

MANAGERS CONTROL
M
Mask switch
CB
T-2 SEC
24 volts
Managers
control
switch


MANAGERS CONTROL
M
Mask switch
CB
T-2 SEC
24 volts
Managers
control
switch

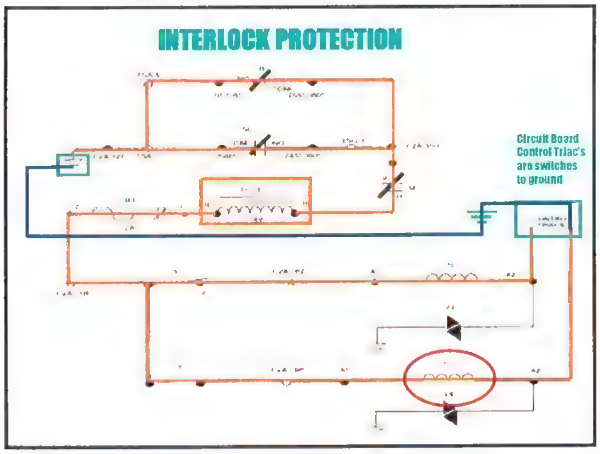

FRAME METER
MANAGERS CONTROL
M
Spot relay
contacts
Mask switch
SP
CB
T-2 SEC
24 volts
Managers
control
switch

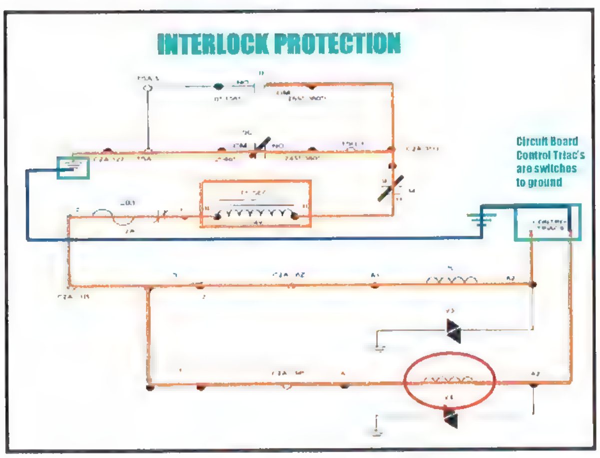

MANAGERS CONTROL
PRACTICE PLAY
M
Mask switch
CB
T-2 SEC
24 volts
Managers
control
switch
GROUND

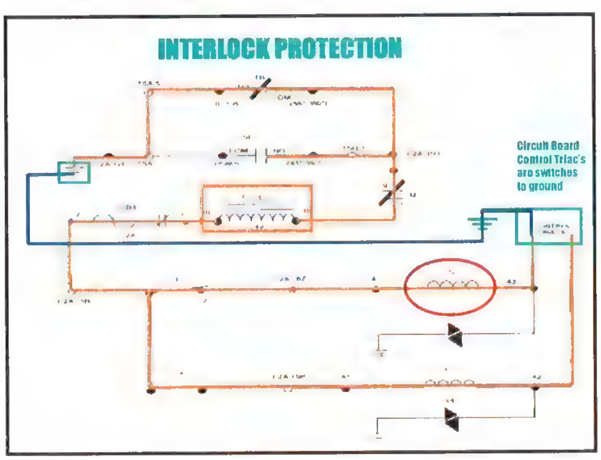


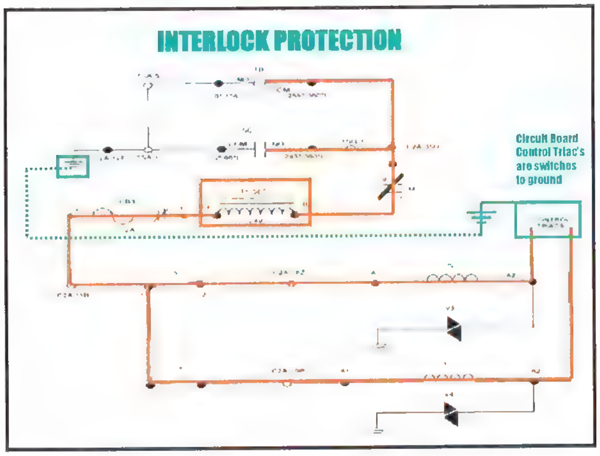


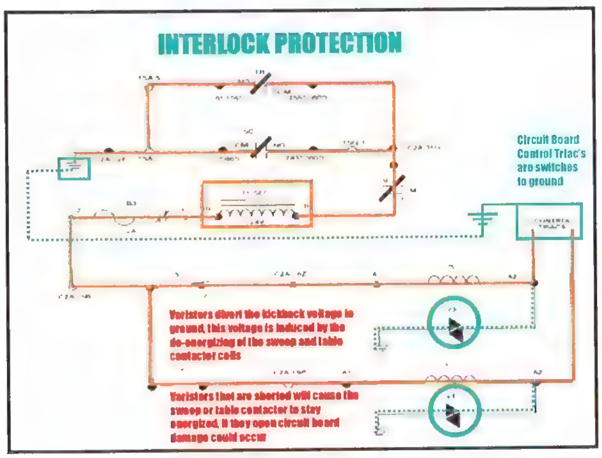
IF VARISTORS GO BAD VOLTAGE
WILL EVENTUALLY BLOW TRIAC'S
CAUSING NO SWEEP OR TORQUE

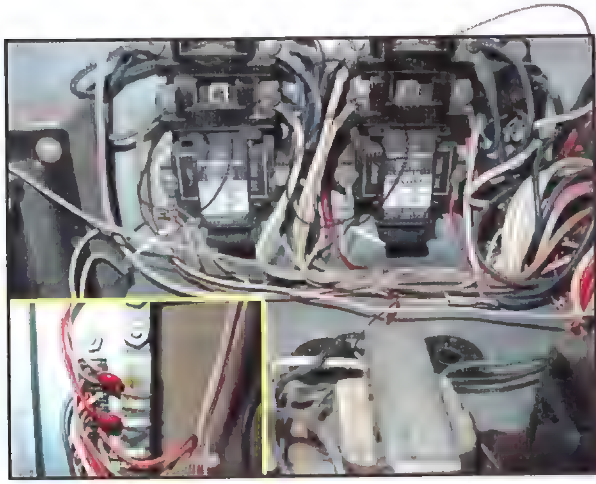

INTERLOCK PROTECTION
Circuit Board
Control Triac's
are switches
to ground


INTERLOCK PROTECTION
Circuit Board
Control Triac's
are switches
to ground


INTERLOCK PROTECTION
Circuit Board
Control Triac's
are switches
to ground







BUTTON FOR [illegible] SWEEP + TABLE FROM RELAY TO GROUND.

Motor Capacitors and Resistors

MCM Part No.: 72-6355

Manufacturer: TENMA

Manufacturer Part No.: 72-6355

Description: ANALOG ESR METER EFFECTIVE SERIES RESISTANCE Tenma ESR Meter, Test Frequency: 50 KHz, Test Range: 1 uF or Larger,

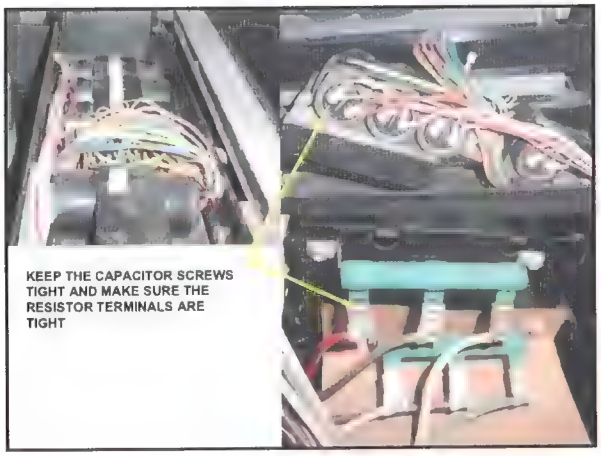
Dimensions: (W x L x D) 3 3/4 x 6 3/4 x 2
Power Requirement: 2 AA Batteries

Includes: Operating instructions and test leads

$125.00

SUPCO MFD-10

Grainger # 3AU42
$66.95



What do capacitors do? Technically wordy version

- Capacitors block the flow of DC current but allow AC current to pass.
- The capacitor and start winding are in series, this comprises a resistive-capacitive circuit which causes the AC current to lead the line voltage by 45^0.
- The main or run winding has enough inductance (AC resistance) to cause the AC current to lag the line voltage by 45^0.

What do capacitors do? Technically wordy version

- The 45^0 lead (start circuit) and 45^0 lag (run circuit) of current, effectively produce 90^0 out of phase current in the start windings, which produces a rotating magnetic field which is 90^0 out of phase of the main windings.
- This provides additional torque to start motors.

What do capacitors do?

- Capacitors block the flow of DC current but allow AC current to pass.
- This produces 90^0 out of phase current in the start windings, which produces a rotating magnetic field in the start windings which is 90^0 out of phase with the rotating magnetic field of the main windings.
- This provides additional torque to start motors.

What do capacitors do?

- The capacitor circuit for the combo motors are part of a regenerative braking circuit.
- They assist with motor braking by acting as a load or "battery" that is being charged

What do resistors do?

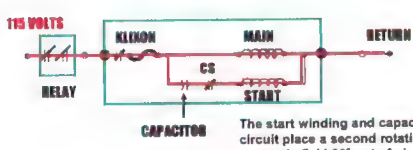
- They bleed off "discharge" unwanted voltage from the capacitors to allow for proper motor braking functions
- Bad resistors or loose connections to them can cause motor drift problems

Concerns about capacitors

- Vent hole must be at top
- Wire terminal screws must be tight
- No visible cracks or leakage
- Discharge prior to removing
- Always use a known “good” capacitor for testing purposes

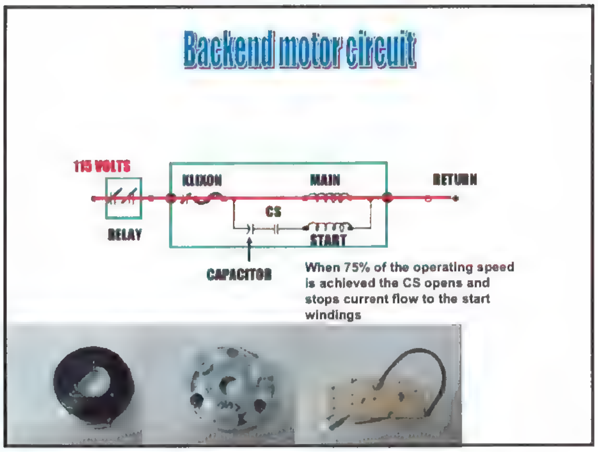
Backend motor Circuit

Backend motor circuit



The start winding and capacitor circuit place a second rotating magnetic field 90° out of phase with the main windings, the two rotating magnetic fields produce the high amount of torque that is needed to start the motor.

This also requires a high amount of current, if the start winding stay in the circuit too long they will burn up.


Backend motor circuit
115 VOLTS
KLIXON
MAIN
RETURN
CS
RELAY
START
CAPACITOR
When 75% of the operating speed is achieved the CS opens and stops current flow to the start windings

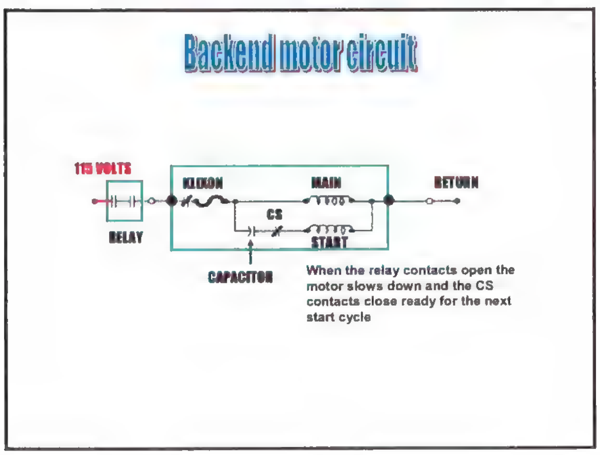

Backend motor circuit
115 VOLTS
KLIXON
MAIN
RETURN
CS
RELAY
START
CAPACITOR
When the relay contacts open the motor slows down and the CS contacts close ready for the next start cycle


Table motor
Circuit

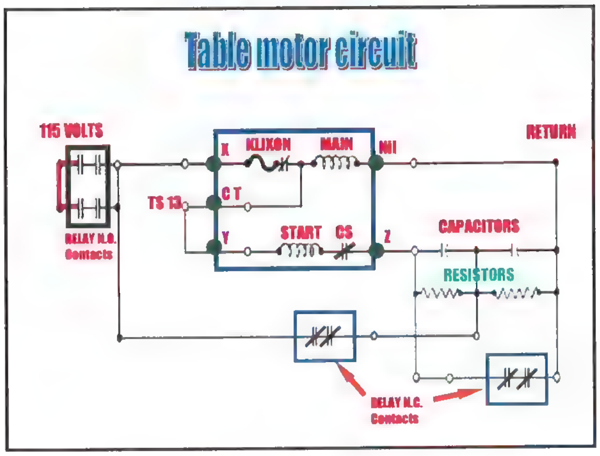


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
MI
CT
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
RELAY N.C. Contacts

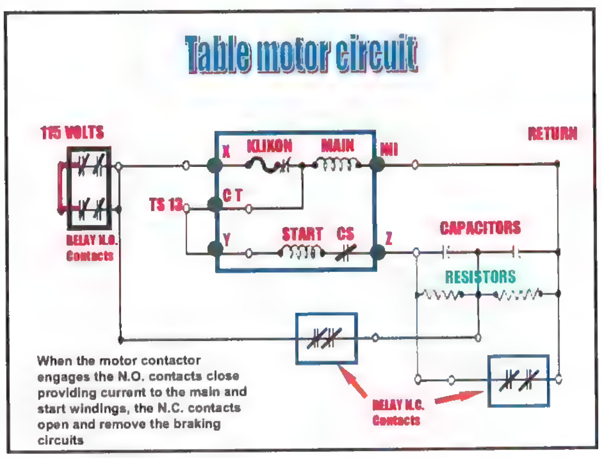


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
MI
CT
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
When the motor contactor engages the N.O. contacts close providing current to the main and start windings, the N.C. contacts open and remove the braking circuits
RELAY N.C. Contacts

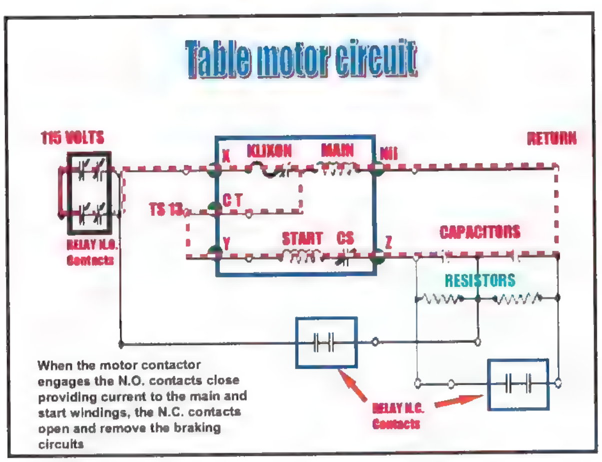


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
MI
CT
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
When the motor contactor engages the N.O. contacts close providing current to the main and start windings, the N.C. contacts open and remove the braking circuits
RELAY N.C. Contacts

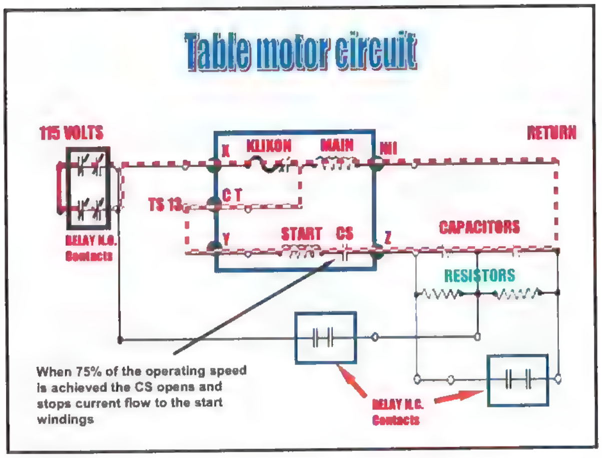


Table motor circuit
115 VOLTS
RETURN
KLIXON
MAIN
X
M1
C T
TS 13
Y
START
CS
Z
CAPACITORS
RESISTORS
RELAY N.O. Contacts
RELAY N.C. Contacts
When 75% of the operating speed is achieved the CS opens and stops current flow to the start windings

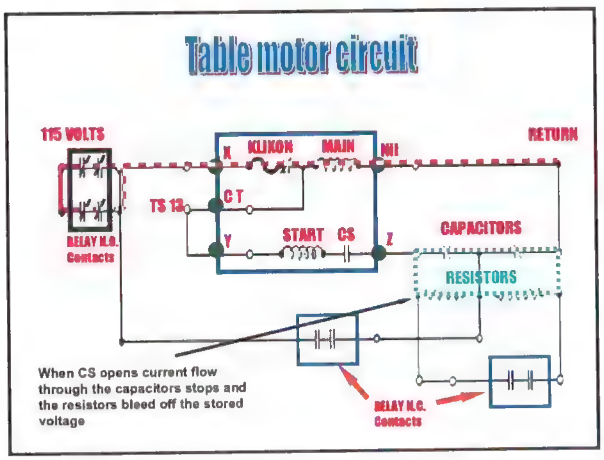


Table motor circuit
115 VOLTS
RETURN
KLIXON
MAIN
X
M1
C T
TS 13
Y
START
CS
Z
CAPACITORS
RESISTORS
RELAY N.O. Contacts
RELAY N.C. Contacts
When CS opens current flow through the capacitors stops and the resistors bleed off the stored voltage

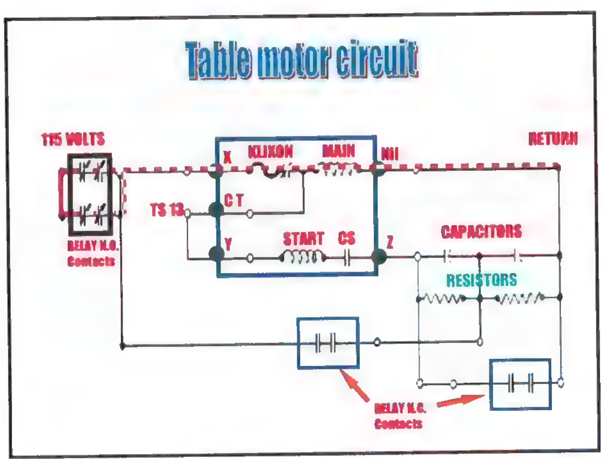


Table motor circuit
115 VOLTS
RETURN
KLIXON
MAIN
X
M1
C T
TS 13
Y
START
CS
Z
CAPACITORS
RESISTORS
RELAY N.O. Contacts
RELAY N.C. Contacts

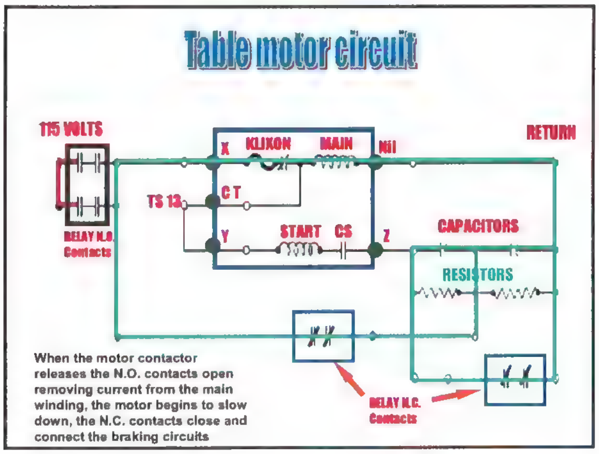


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
NII
C T
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
RELAY N.C. Contacts
When the motor contactor releases the N.O. contacts open removing current from the main winding, the motor begins to slow down, the N.C. contacts close and connect the braking circuits

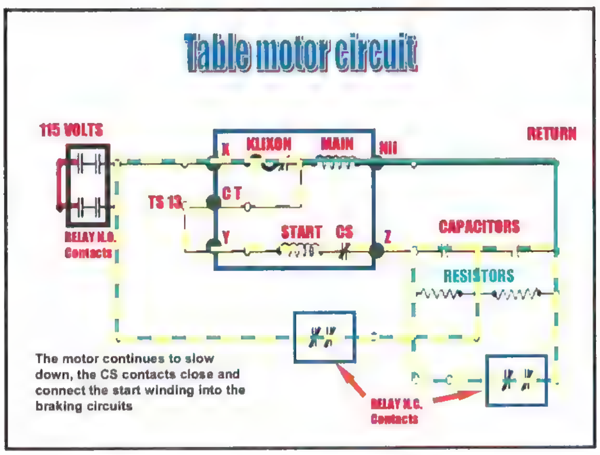


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
NII
C T
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
RELAY N.C. Contacts
The motor continues to slow down, the CS contacts close and connect the start winding into the braking circuits

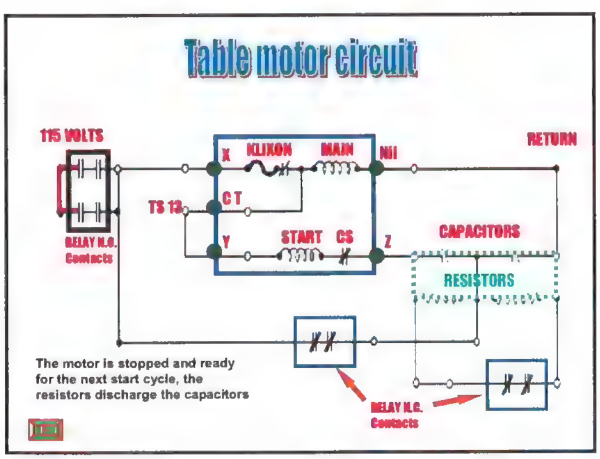
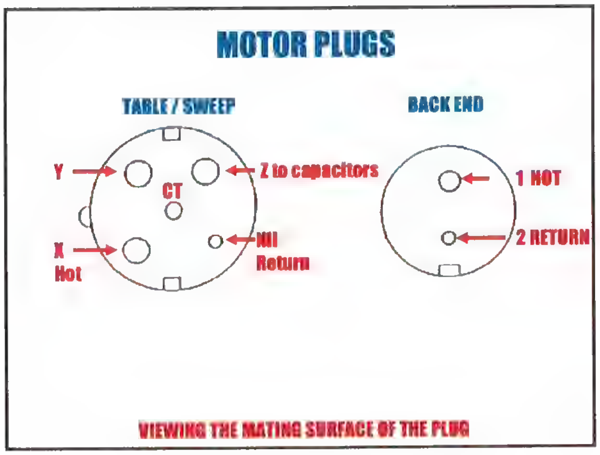
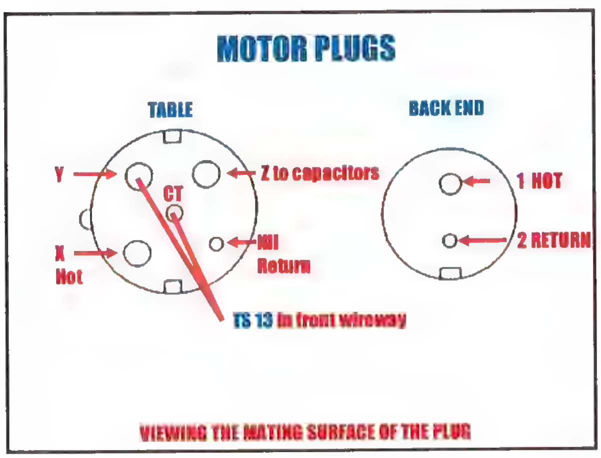
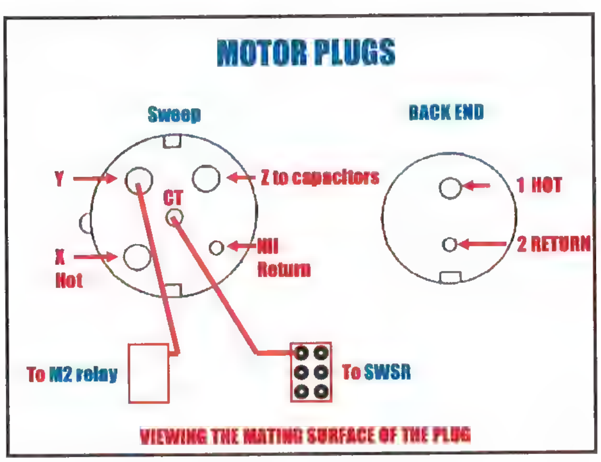


Table motor circuit
115 VOLTS
RELAY N.O. Contacts
TS 13
X
KLIXON
MAIN
NII
C T
Y
START
CS
Z
RETURN
CAPACITORS
RESISTORS
RELAY N.C. Contacts
The motor is stopped and ready for the next start cycle, the resistors discharge the capacitors


MOTOR PLUGS
TABLE / SWEEP
BACK END
Y
Z to capacitors
CT
X
Hot
NII
Return
1 HOT
2 RETURN
VIEWING THE MATING SURFACE OF THE PLUG


MOTOR PLUGS
TABLE
BACK END
Y
Z to capacitors
CT
X
Hot
NII
Return
1 HOT
2 RETURN
TS 13 in front wireway
VIEWING THE MATING SURFACE OF THE PLUG


MOTOR PLUGS
Sweep
BACK END
Y
Z to capacitors
CT
X
Hot
NII
Return
1 HOT
2 RETURN
To M2 relay
To SWSR
VIEWING THE MATING SURFACE OF THE PLUG

Causes of drifting motors

- Bad capacitors
- Wire terminal screws on capacitors are loose
- Bad resistors or loose connections
- N.C. contacts on contactor bad
- C1 pins burned or loose
- Broken wire (open circuit)

Causes of drifting motors

- Loose gearbox components
- Improper gear oil
- Wire scraps in front wireway
- Solid state CS
- Carbon plugs missing on national motors

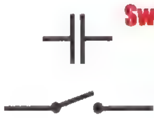
Some causes of motors that do not run or hum

- Bad capacitors
- Bad set of N.O. contacts on contactor
- Open start winding
- Bad or loose C1 pins
- Bad or loose motor plug wiring
- Bad contactor coil
- Bad MP board

Some causes of motors that do not run or hum

- Bad capacitor
- Loose wires on capacitors
- Bad resistor
- Bad klixon
- Bad CS
- Bad governor

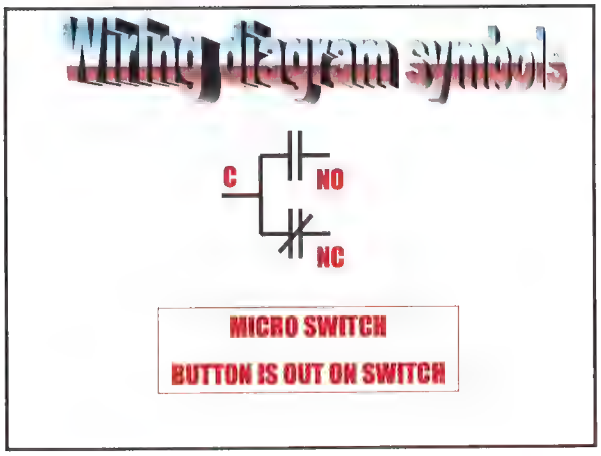
Wiring diagram symbols

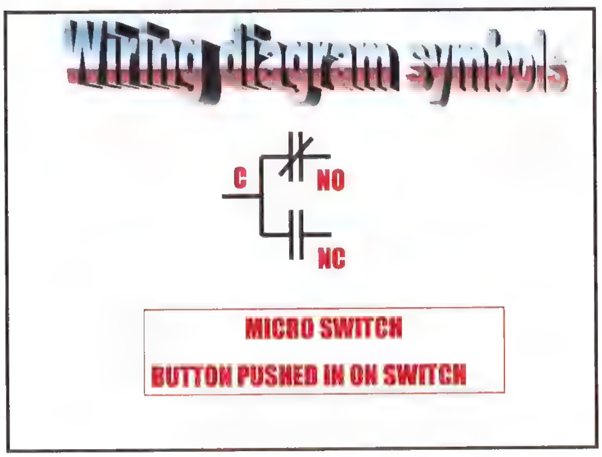


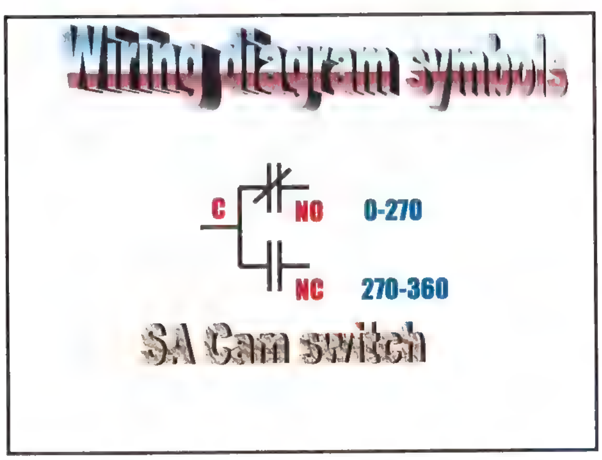
Switch Contacts that are open or off

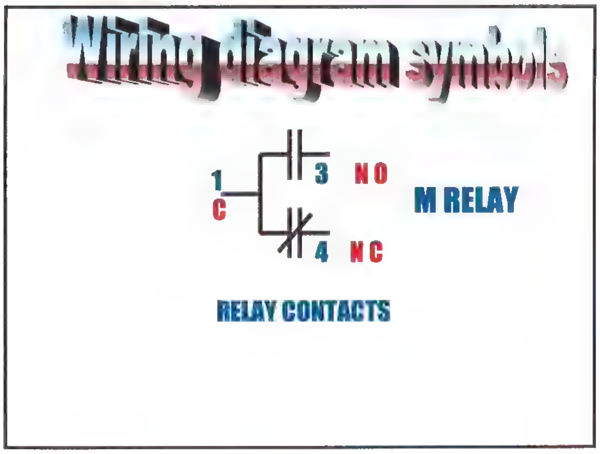
Wiring diagram symbols

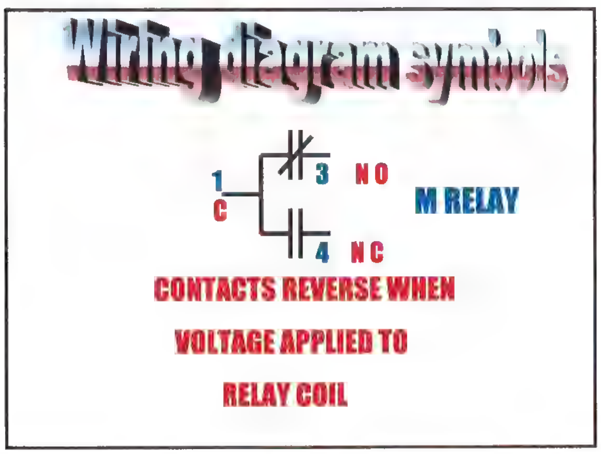
Switch Contacts that are closed or on

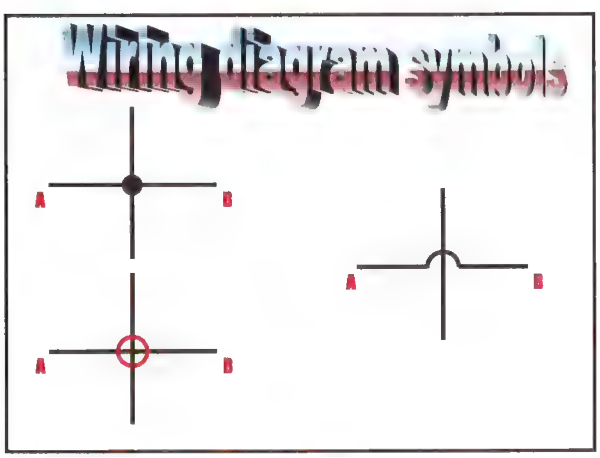

Wiring diagram symbols
C
NO
NC
MICRO SWITCH
BUTTON IS OUT ON SWITCH

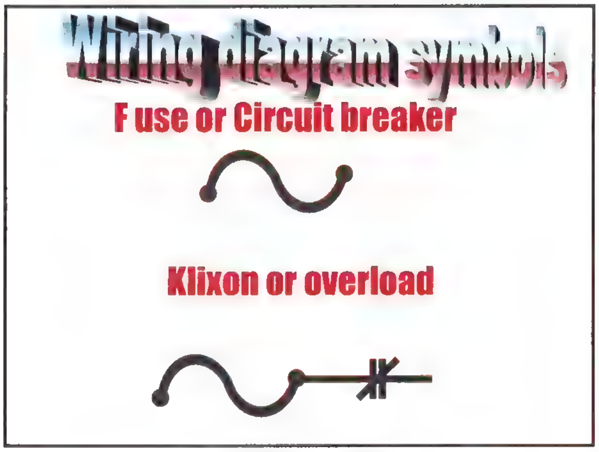

Wiring diagram symbols
C
NO
NC
MICRO SWITCH
BUTTON PUSHED IN ON SWITCH


Wiring diagram symbols
C
NO
0-270
NC
270-360
SA Cam switch

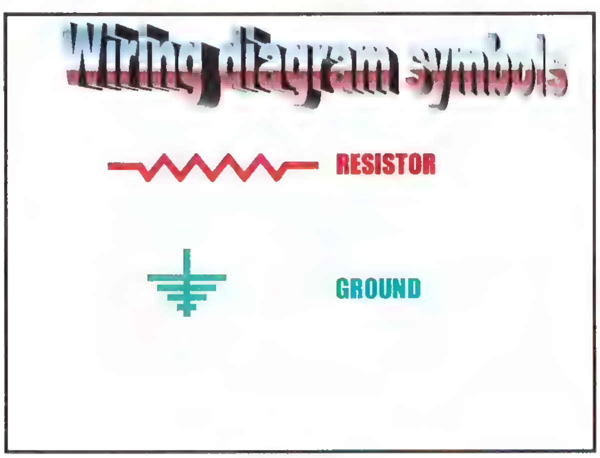

Wiring diagram symbols
1
C
3
N O
4
N C
M RELAY
RELAY CONTACTS

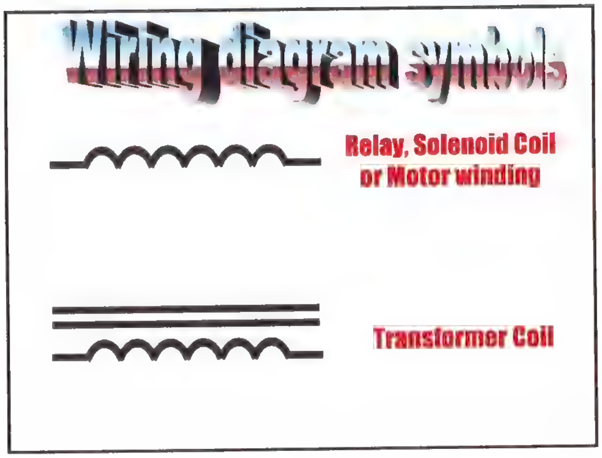

Wiring diagram symbols
1
C
3
N O
4
N C
M RELAY
CONTACTS REVERSE WHEN
VOLTAGE APPLIED TO
RELAY COIL

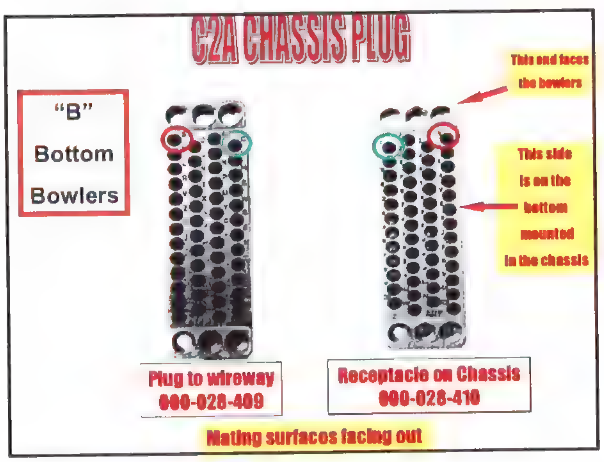

Wiring diagram symbols
A
B
A
B
A
B

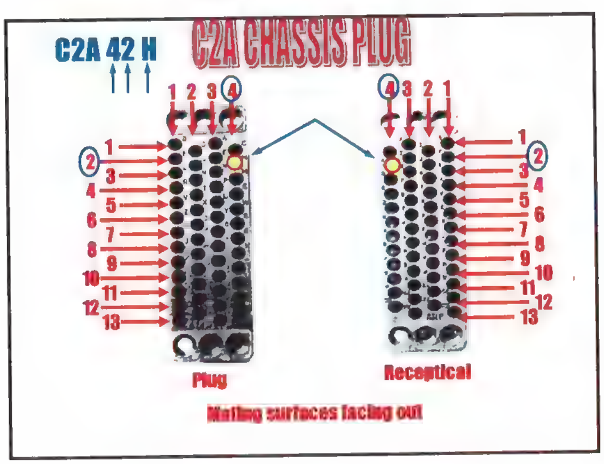

Wiring diagram symbols
F use or Circuit breaker
Klixon or overload

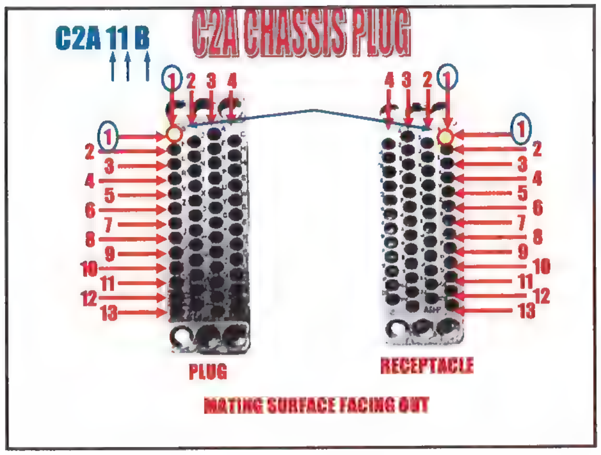

Wiring diagram symbols
CAPACITOR

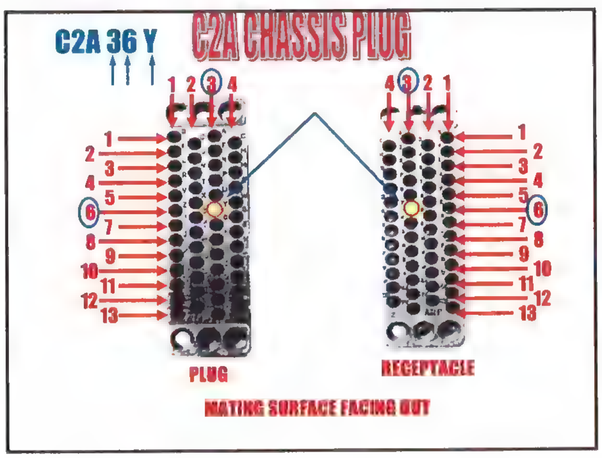

Wiring diagram symbols
RESISTOR
GROUND

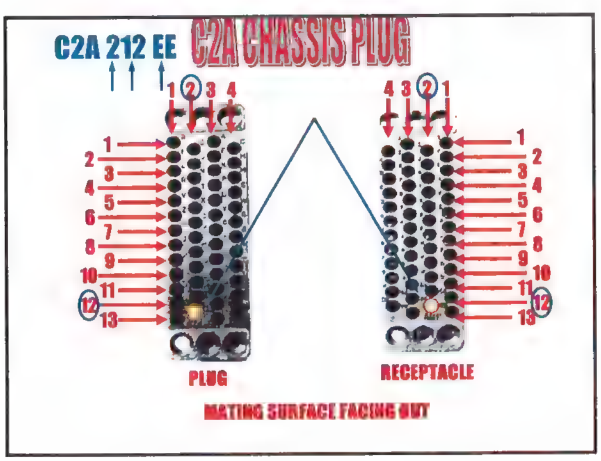

Wiring diagram symbols
Relay, Solenoid Coil
or Motor winding
Transformer Coil


C2A CHASSIS PLUG
"B"
Bottom
Bowlers
This end faces
the bowlers
This side
is on the
bottom
mounted
in the chassis
Plug to wireway
000-028-409
Receptacle on Chassis
000-028-410
Mating surfaces facing out


C2A 42 H
C2A CHASSIS PLUG
1 2 3 4
4 3 2 1
1 2 3 4 5 6 7 8 9 10 11 12 13
Plug
Receptical
Mating surfaces facing out

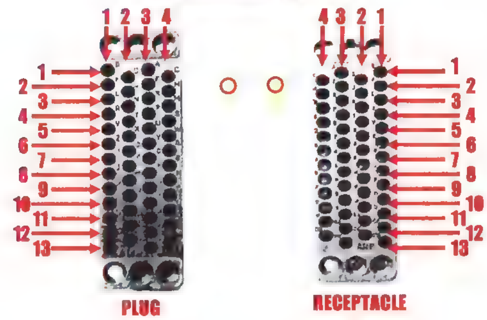

C2A 11 B
C2A CHASSIS PLUG
PLUG
RECEPTACLE
MATING SURFACE FACING OUT


C2A 36 Y
C2A CHASSIS PLUG
PLUG
RECEPTACLE
MATING SURFACE FACING OUT


C2A 212 EE
C2A CHASSIS PLUG
PLUG
RECEPTACLE
MATING SURFACE FACING OUT

C2A 311

C2A CHASSIS PLUG



MATING SURFACE FACING OUT

CIRCUIT TESTING AT THE C2A PLUG

REMOVE POWER PLUG--USE CONTINUITY TESTER

TO TEST	USE C2A TERMINALS
T SWITCH	19P and 11B
S SWITCH	16Z AND 11B
PBZ SWITCH	12F AND 212EE
SWS 4/6	312BB AND 21D
SS	27F AND 14R
PBC	27F AND 14R
10th Frame	31A AND 32E
BS	112CC AND 25X

CIRCUIT TESTING AT THE C2A PLUG

REMOVE POWER PLUG--USE CONTINUITY TESTER

TO TEST	USE C2A TERMINALS
OS	210W AND 24T
GP	412 DD and 28m
TA 1 n.o.	39n and 312BB or 310t
TA 1 n.c.	110u AND 312BB
TA 2 n.o.	312BB and 25X looks like n.c. (6730)
TA 2 n.c.	312BB and 211AA
TB n.o.	12F and 35U
TB n.c.	Not used

CIRCUIT TESTING AT THE C2A PLUG

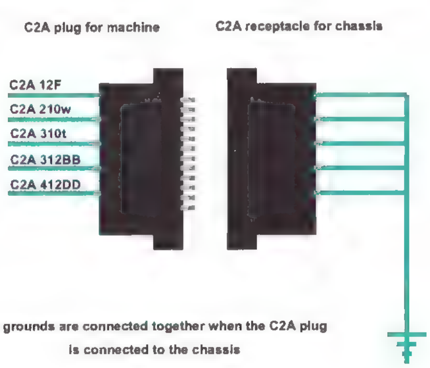
REMOVE POWER PLUG--USE CONTINUITY TESTER

TO TEST	USE C2A TERMINALS
SA n.o.	312BB and 27 F
SA n.c.	312BB and 29s
SB n.o.	312BB and 111y (5500)
SB n.c.	312BB and 311x
SC n.o.	12F and 35U
SC n.c.	411z and 12 F

CIRCUIT TESTING AT THE C2A PLUG

REMOVE POWER PLUG--USE CONTINUITY TESTER

TO TEST	USE C2A TERMINALS
GS-1	310t and 41C
GS-2	310t and 42H
GS-3	310t and 43M
GS-4	310t and 44S
GS-5	310t and 45W
GS-6	310t and 46a
GS-7	310t and 47e
GS-8	310t and 48k
GS-9	310t and 49r
GS-10	310t and 410v

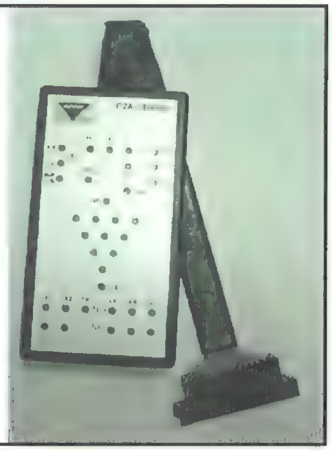


All grounds are connected together when the C2A plug is connected to the chassis

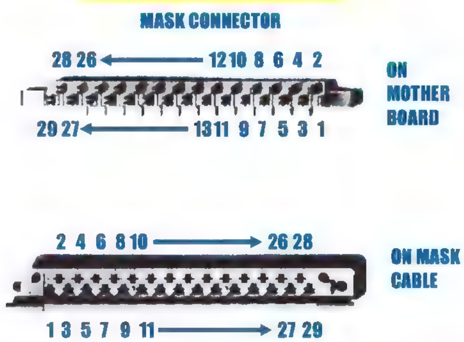
C2A circuit tester

791-003-004

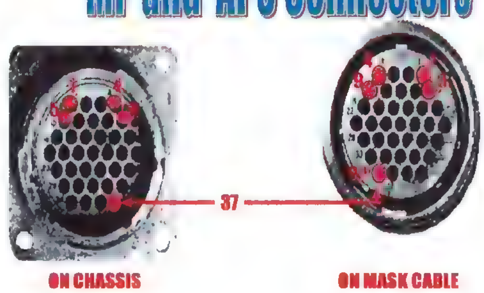
$169.95



ELCO CHASSIS



MP and APS Connectors



Expense & Report

AMF

BOWLING TECH

Expense report procedures

BOWLING TECH

BCO REBATE PROGRAM

What is reimbursed?

100 % of the student's payroll for the two-week course, this will be 80 hours at the employee's base pay rate.

100 % of the student's travel and accommodation expenses.

How does the center qualify for the rebate?

- The student must attend the two-week course and achieve a score of at least 85%.
- The student must have perfect attendance.
- Test #4 must be completed

How does the center receive the rebate?

Payroll

The center manager must process center payroll in the usual manner for the employee as if he/she had worked at the center.
The center manager must complete the Bowling Tech Payroll Rebate form and send it to:

John Isbell
Manager, AMF Bowling Tech
E-Mail Jisbell@AMF.com or Fax # 281-491-6395.

Manager, Bowling Tech will submit the approved rebate form to payroll. A journal entry will be made at month-end for the rebated amount, crediting the center's P&L payroll line.

BOWLING TECH

BCO REBATE PROGRAM

Travel expenses

Note: in accordance with AMF travel policy, all employees traveling must pay for any travel related expenses and submit an expense report for reimbursement.

All travel arrangements must be made BY THE BOWLING CENTER MANAGER through ARCHER TRAVEL at the corporate office, the contact numbers are on the last page of this form.

Bowling Tech has a credit account for hotel and airfare charges, those charges will be divided between your center and Bowling Tech after the successful completion of the course.

Archer travel will be provided with a list of hotels near the hosting center.

The student must fill out an AMF travel expense in accordance with AMF guidelines; the student should keep a copy of the report and receipts.

The original expense report with all receipts attached must be sent to:

John Isbell, Manager
AMF Bowling Tech
4919 S. Main St
Stafford TX 77477

- Please fill out the form using a black pen
- Insert your center #
- The date of the report this is usually the day after the week ending date
- The department “BCO”

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center	
Date	
Department	

Period Covered
From: To:

NAME

Mailing Address

Purpose of Travel:

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature: Date:

Approved by: Date:

TOTAL ALL	
Less Travel Advance	
AMOUNT DUE EMPLOYEE	

Period covered runs from Monday to Sunday for each report

You must have a report for each week, do not put 2 weeks of expenses on one report

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered
Date		From: To:
Department		

NAME

Mailing Address

Purpose of Travel:

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Your name

TRAVEL EXPENSE REPORT

AMF

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME

Mailing Address

Date:								TOTAL
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Your address

AMF

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center	
Date	
Department	

Period Covered	
From:	To:

NAME

Mailing Address

Purpose of Travel:

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Purpose of travel
"Attend AMF Bowling Tech class at XXX location"

TRAVEL EXPENSE REPORT

AMF

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME

Mailing Address

Purpose of Travel:

Date:								TOTAL
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Date- 1,2,3,4

City you are in for travel

Miles driven- Daily mileage less your normal commute to work

Example: your normal round trip miles to work is 10 miles, your round trip miles to class is 30, you may enter 20 miles per day.

Total the mileage across

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME

Mailing Address

Purpose of Travel:

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Mileage calculation:

Multiply each days mileage by 40.5 cents

10 X 40.5= $40.50

Total mileage $ across

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center	
Date	
Department	

Period Covered	
From:	To:

NAME	Mailing Address
Purpose of Travel:	

Date:								TOTAL
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	AMOUNT DUE EMPLOYEE	

Insert you amounts for:

Hotels, Airfare, taxi, tips, rental car, rental car gas, tolls,parking fees.

You must have receipts for everything

In room entertainment movies, etc.. are not allowed

Total each column down and each row across

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME	Mailing Address

Purpose of Travel:

Date:								TOTAL
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Insert you amount for:

Meals

You must have receipts for everything

Room service is not allowed,

Pizza delivery is OK

Put each meal in its own slot, breakfast, lunch and dinner, do not add up all receipts and put in one entry

Total each column down and each row across

AMF

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME	Mailing Address
Purpose of Travel:	

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Insert your amount for:

Telephone, fax, postage, supplies, other

It is best to purchase a phone card, do not use the hotel room phone for long distance, use a payphone and your phonecard.

You must have receipts for everything

Total each column down and each row across

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered
Date		From: To:
Department		

NAME	Mailing Address

Purpose of Travel: ______

Date: / City: / Miles:								TOTAL
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	AMOUNT DUE EMPLOYEE	

Total all:

Add the amounts in the three categories

Subtract and travel advance

Total the report

Sign and date the report

You must have receipts for everything

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center		Period Covered	
Date		From:	To:
Department			

NAME	Mailing Address

Purpose of Travel:

								TOTAL
Date:								
City:								
Miles:								
Auto Mileage ($.36.5 /mile)								
Auto Mileage ($.11/ mile)								
Hotel								
Airfare								
Taxi								
Tips (Hotel, Taxi, etc.)								
Rental Car								
Rental Car Gas								
Tolls								
Parking Fees								
TOTAL TRAVEL								
Your Meals While Traveling								
Breakfast								
Lunch								
Dinner								
Guest Meals/Entertainment (detail below)								
TOTAL MEALS/ENTERTAINMENT								
Telephone								
Fax								
Postage								
Supplies								
Other								
TOTAL OTHER EXPENSES								

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date:	TOTAL ALL	
		Less Travel Advance	
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	

Staple to the **back side** of the report in this corner

You must have receipts for everything

Attach the receipts in date order to the back side of the expense report.

AMF

TRAVEL EXPENSE REPORT

OTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center	1657	Period Covered	
Date	6/17/02	From:	To:
Department	BCS	6/10/02	6/16/02

NAME: **John Isbell**

Mailing Address: 12326 Scottsdale Drive, Stafford, Texas 77477-1436

Purpose of Travel: AMF pinspotter school, seminars   Syosset NY

Date:	10	11	12	13	14	15	16	TOTAL
City:	Syosset	Syosset	Syosset	Syosset	Syosset	Syosset	Houston	
Miles:						50		50
Auto Mileage ($.36.5 /mile)	0.00	0.00	0.00	0.00	0.00	18.25	0.00	18.25
Auto Mileage ($.11/ mile)								0.00
Hotel						111.94		111.94
Airfare								0.00
Taxi								0.00
Tips (Hotel, Taxi, etc.)					10.00			10.00
Rental Car						951.30		951.30
Rental Car Gas						16.10		16.10
Tolls						2.25		2.25
Parking Fees						156.00		156.00
TOTAL TRAVEL	**0.00**	**0.00**	**0.00**	**0.00**	**10.00**	**1255.84**	**0.00**	**1265.84**
Your Meals While Traveling								
Breakfast	3.54				4.93			8.47
Lunch		5.41	5.85	6.05				17.31
Dinner	12.36	11.36	12.82		17.53			54.07
Guest Meals/Entertainment (detail below)								0.00
TOTAL MEALS/ENTERTAINMENT	**15.90**	**16.77**	**18.67**	**6.05**	**22.46**	**0.00**	**0.00**	**79.85**
Telephone								0.00
Fax								0.00
Postage								0.00
Supplies								0.00
Other								0.00
Pinspotter school supplies 1657.6370								0.00
								0.00
TOTAL OTHER EXPENSES	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date: 6/17/02	TOTAL ALL	1,345.69
		Less Travel Advance	0.00
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	1,345.69

Forward the reports to:

John Isbell, Manager
AMF Bowling Tech
4919 S. Main St
Stafford TX 77477

Please use UPS next day or 2nd day air
DO NOT SEND VIA INTER COMPANY MAIL

You must have receipts for everything

AMF.

TRAVEL EXPENSE REPORT

NOTE: SEE TRAVEL POLICY FOR GUIDELINES

Cost Center	1657	Period Covered	
Date	6/17/02	From:	To:
Department	BCS	6/10/02	6/16/02

NAME: John Isbell

Mailing Address: 12326 Scottsdale Drive, Stafford, Texas 77477-1436

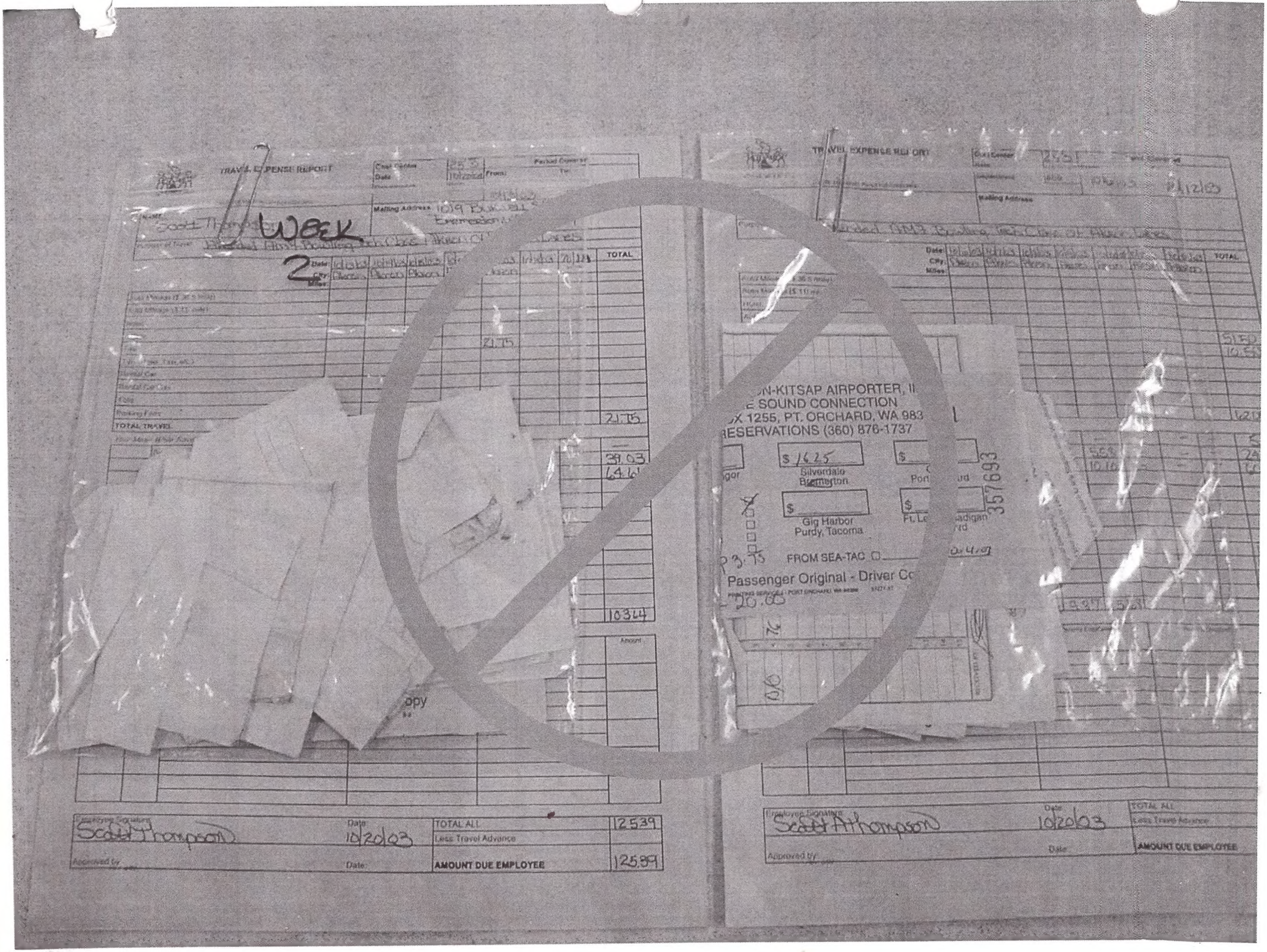
Purpose of Travel: AMF pinspotter school, seminars Syosset NY

Date:	10	11	12	13	14	15	16	TOTAL
City:	Syosset	Syosset	Syosset	Syosset	Syosset	Syosset	Houston	
Miles:						50		50
Auto Mileage ($.36.5 /mile)	0.00	0.00	0.00	0.00	0.00	18.25	0.00	18.25
Auto Mileage ($.11/ mile)								0.00
Hotel						111.94		111.94
Airfare								0.00
Taxi								0.00
Tips (Hotel, Taxi, etc.)					10.00			10.00
Rental Car						951.30		951.30
Rental Car Gas						16.10		16.10
Tolls						2.25		2.25
Parking Fees						156.00		156.00
TOTAL TRAVEL	**0.00**	**0.00**	**0.00**	**0.00**	**10.00**	**1255.84**	**0.00**	**1265.84**
Your Meals While Traveling								
Breakfast	3.54				4.93			8.47
Lunch		5.41	5.85	6.05				17.31
Dinner	12.36	11.36	12.82		17.53			54.07
Guest Meals/Entertainment (detail below)								0.00
TOTAL MEALS/ENTERTAINMENT	**15.90**	**16.77**	**18.67**	**6.05**	**22.46**	**0.00**	**0.00**	**79.85**
Telephone								0.00
Fax								0.00
Postage								0.00
Supplies								0.00
Other								0.00
Pinspotter school supplies 1657.6370								0.00
								0.00
TOTAL OTHER EXPENSES	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

DETAILS OF GUEST MEALS/ENTERTAINMENT (Amount included above)

DATE	Type	Name & Location of Establishment	Persons Entertained	Business Discussed	Amount

Employee Signature:	Date: 6/17/02	TOTAL ALL	1,345.69
		Less Travel Advance	0.00
Approved by:	Date:	**AMOUNT DUE EMPLOYEE**	1,345.69



TRAVEL EXPENSE REPORT
WEEK 2
Mailing Address 1019 Burwell St. Bremerton
21.75
TOTAL TRAVEL
21.75
39.03
64.61
103.44
Employee Signature Scott Thompson
Date 10/20/03
TOTAL ALL 125.39
Less Travel Advance
AMOUNT DUE EMPLOYEE 125.39
TRAVEL EXPENSE REPORT
2551
Mailing Address
...N-KITSAP AIRPORTER, I...
...E SOUND CONNECTION
...X 1255, PT. ORCHARD, WA 983...
...ESERVATIONS (360) 876-1737
$ 16.25
Silverdale Bremerton
$
Gig Harbor Purdy, Tacoma
FROM SEA-TAC
357693
Passenger Original - Driver Co...
20.00
Employee Signature Scott A Thompson
Date 10/20/03
TOTAL ALL
Less Travel Advance
AMOUNT DUE EMPLOYEE